A PROSPECTIVE DOUBLE BLINDED RANDOMIZED STUDY TO COMPARE SUPRACLAVICULAR Vs INFRACLAVICULAR BLOCKS FOR FOREARM SURGERIES UNDER NERVE STIMULATOR GUIDANCE

A STUDY OF 60 CASES

DISSERTATION

Submitted to **THE TAMILNADU Dr. M.G.R MEDICAL UNIVERSITY** in partial fulfillment of university regulations for the award of the degree of

DOCTOR OF MEDICINE IN **ANAESTHESIOLOGY**

BRANCH X

THE TAMIL NADU

Dr. M. G. R. MEDICAL UNIVERSITY

CHENNAI -600 003

APRIL 2018

CERTIFICATE

This is to certify that the dissertation titled, **"A PROSPECTIVE DOUBLE BLINDED RANDOMIZED STUDY TO COMPARE SUPRACLAVICULAR Vs INFRACLAVICULAR BLOCKS FOR FOREARM SURGERIES UNDER NERVE STIMULATOR GUIDANCE"** Submitted by **Dr. J. ROSEBELL** is an original work done by her in the Department of Anaesthesiology Kanyakumari Government Medical College Hospital, Asaripallam, Nagercoil for the award of the degree of M.D. (Branch X) Anaesthesiology during the academic year 2015-2018.

The DEAN

Kanyakumari Government Medical College Hospital,

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DECLARATION

I, **Dr. J. ROSEBELL hereby** declare that the dissertation titled **"A PROSPECTIVE DOUBLE BLINDED RANDOMIZED STUDY TO COMPARE SUPRACLAVICULAR Vs INFRACLAVICULAR BLOCKS FOR FOREARM SURGERIES UNDER NERVE STIMULATOR GUIDANCE"** has been done by me.

This is submitted to the Tamil Nadu Dr. M.G.R. Medical University, Chennai, in partial fulfillment of the requirement for the award of M.D. degree, Branch – X (ANAESTHESIOLOGY). Degree Examination to be held in May 2018.

Place : Asaripallam

Date :

Dr. J. ROSEBELL

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CONTENTS

INTRODUCTION

"Peripheral nerve blocks can be customized and used for anaesthesia, post operative analgesia and diagnosis and treatment of chronic pain disorders"[33]. Nerves or plexus supplying a particular region is blocked using local anesthetic and is made insensitive to pain and reflex responses to surgical stimuli. It is superior to general anesthesia in many aspects like sparing CNS, keeping the patient alert, awake and cooperative and avoiding polypharmacy. It can be used both for elective as well as emergency surgeries.

The Viennese ophthalmologist Dr. Karl Koller introduced cocaine as the first local anaesthetic in 1884. He used cocaine solution for topical corneal anaesthesia in patients undergoing ophthalmic surgeries. The initial local anesthetic agents developed during the first half of 20th century were amino ester compounds. The main disadvantages were shorter duration of action, allergy and systemic toxicity. Then the amino amide compounds were discovered. Levo-Bupivacaine is an amide type of long acting local anaesthetic agent which facilitates its usage to carry out prolonged surgeries in extremities. Additives to local anaesthetic helps to overcome the delayed onset of action and inadequate quality of blockade.

"Brachial plexus block was first done by William Steward Halsted in the year1889. He applied cocaine to the brachial plexus using surgical approach. Later

different approaches have been designed in order to block Brachial plexus at various levels. The use of electrical stimulation to locate peripheral nerves was introduced in the year 1962"[9].

The important approaches were

1) "Interscalene approach
2) Classical supraclavicular approach by Kulenkampff
3) Subclavian perivascular approach by Winnie and Collins
4) Infraclavicular approach by Raj
5) Axillary approach by Accardo and Adriano.

However complications like Pneumothorax, inadvertent arterial puncture, subarachnoid puncture, phrenic nerve paralysis have been reported in the foresaid approaches"[9].

"In supraclavicular block, blockade occurs at the distal trunk – proximal division level"[33]. At this location the brachial plexus is compact and even small volume of local anaesthetic injection produces rapid onset of reliable blockade of the brachial plexus.

"In infraclavicular block, the blockade occurs at the level of cords and offers advantages of avoiding complications like pneumothorax and this approach also offers blockade of musculo-cutaneous and axillary nerves"[33].

The various techniques used to locate the peripheral nerves include paresthesia techniques, peripheral nerve stimulation and ultrasound guidance. Electrical nerve stimulation is used not only to locate nerves but also to rule out intraneural location of the needle. This technique also provides high success rate. In this study we compare the effectiveness, time of readiness for surgery, quality of blockade, duration of sensory and motor blockade and duration of analgesia with supra-clavicular vs infra-clavicular blocks for forearm surgeries using levo-bupivacaine and lignocaine with adrenaline under nerve stimulator guidance.

AIM OF THE STUDY

The aim and objective of this study is to compare the time of readiness for surgery, quality of blockade, duration of sensory and motor blockade and duration of analgesia with supra-clavicular vs infra-clavicular blocks for forearm surgeries using levo-bupivacaine and lignocaine with adrenaline under nerve stimulator guidance.

ANATOMY OF THE BRACHIAL PLEXUS

Brachial plexus block is commonly used for the surgeries in the upper limb. It can be used as a sole anaesthetic technique or with general anaesthesia to provide intra-operative as well as postoperative analgesia. Absolute knowledge about the formation and distribution of brachial plexus and its relation to adjacent structures is essential for successful administration of brachial plexus blockade.

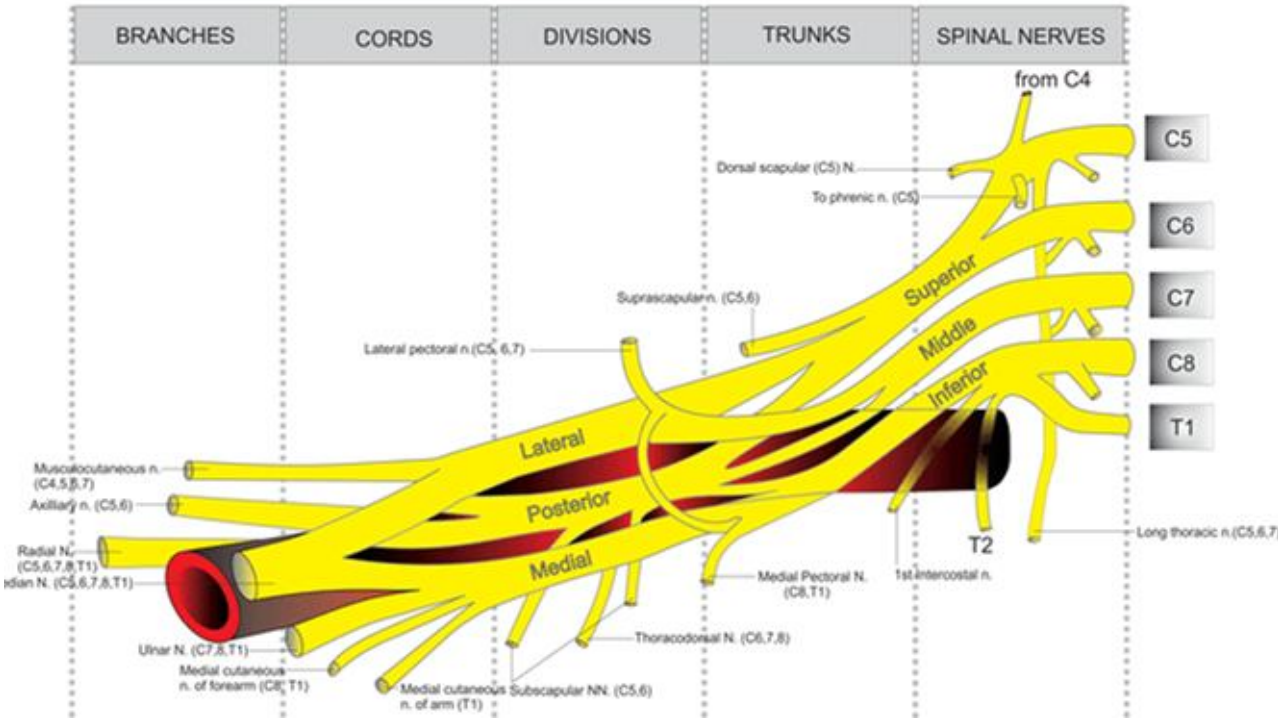
"In its course from the inter-vertebral foramina to the upper arm, the brachial plexus is composed of

1) Roots,
2) Trunks,
3) Divisions,
4) Cords,
5) Branches in consecutive manner.

ROOTS:

Roots of the brachial plexus are formed by the anterior primary rami of C5, C6, C7, C8 together with the bulk of, first thoracic nerve. Occasionally the plexus is derived from C4-C8 (prefixed plexus) or from C6-T2 and (post fixed plexus). These variations are usually associated with anomalous first rib.

ORGANIZATION OF THE BRACHIAL PLEXUS:



TRUNKS:

As the five roots of the brachial plexus emerge from the intervertebral foramina, they lie in the groove between the scalenus anterior and scalenus medius muscles.

Roots of C5 and C6 unite to form Upper trunk

Root of C7 continues as the Middle Trunk

Roots of C8 and T1 unite to form the Lower trunk.

When crossing the first rib the trunks lies cephalo-posterior to the subclavian artery and enclosed by a connective tissue sheath.

DIVISIONS:

Behind the clavicle each trunk divides into

1) Anterior Division
2) Posterior Division

Totally six divisions are formed.

CORDS:

The six divisions then enter the axilla and combine to form three cords in the upper part of axilla as follows

1) LATERAL CORD is formed by the union of the anterior divisions of Upper and middle trunks

2) MEDIAL CORD is formed by the continuation of the anterior division of the lower trunk.

3) POSTERIOR CORD is formed by the union of the posterior divisions of all the three trunks.

BRANCHES:

Branches are given off from roots, trunks and cords.

a) Branches from the roots:

1) Nerve to Serratus anterior C5,C6 and C7

2) Muscular branches to

- Longus cervices C5-C8
- Three scalene muscles C5-C8
- Rhomboids C5

3) Twig to the phrenic nerve C5

b) Branches from the Trunks:

1) Supra scapular nerve C5-C6

2) Nerve to Subclavius C5-C6

c) Branches from the Cords :

1) Lateral cord :

- Lateral pectoral nerve C5-C7
- Lateral head of Median nerve C5-C7

- Musculocutaneous Nerve C5-C7

2) Medial cord:

- Medial pectoral Nerve C8-T1

- Medial cutaneous nerve of arm C8-T1

- Medial cutaneous nerve of forearm C8-T1

- Medial root of Median nerve C8-T1

- Ulnar nerve C7,C8-T1

3) Posterior cord :

- Upper subscapular C5-C6

- Lower subscapular C5-C6

- Axillary nerve C5-C6

- Thoracodorsal nerve or Nerve to Lattismus dorsi C6,C7,C8

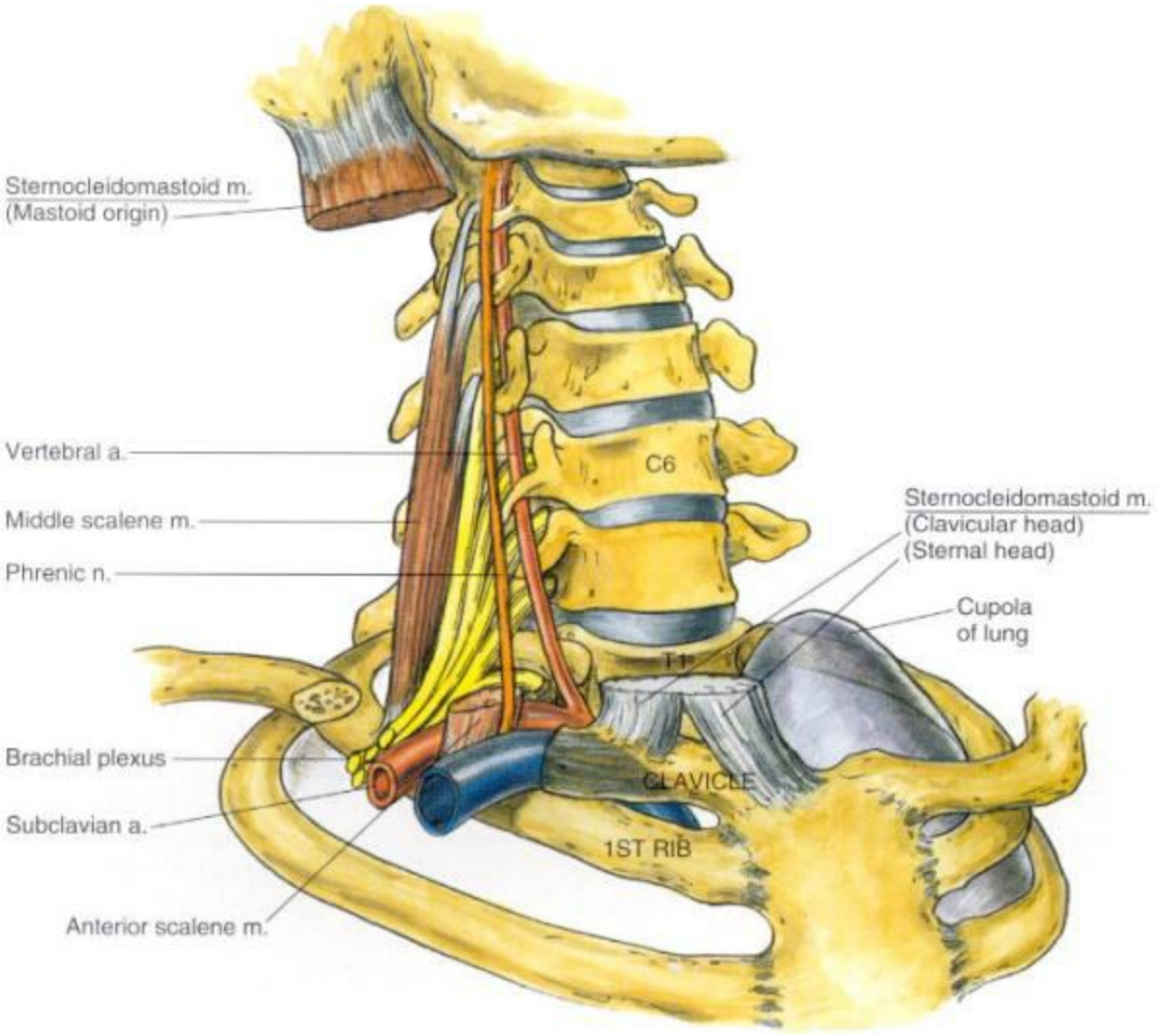
- Radial nerve C5,C6,C7,C8,T1"[9]

RELATIONSHIP OF BRACHIAL PLEXUS TO ADJACENT STUCTURES

ROOTS :

The roots lie between Scalenus anterior and Scalenus medius muscles. They lie above the second part of the subclavian artery. The classical interscalene approach blocks the brachial plexus at the root level.

RELATIONSHIP OF THE BRACHIAL PLEXUS



TRUNKS:

The trunks are invested in the sheath of pre-vertebral fascia in the posterior triangle of the neck. They are superficially placed and covered by Skin, Platysma and deep fascia.

Upper and Middle trunks lie above the subclavian artery as they run across the First rib. Lower trunk lie behind the subclavian artery and may groove the first rib. The sub-clavian peri-vascular approach blocks the trunks.

DIVISIONS:

The trunks of the brachial plexus bifurcate into anterior and posterior divisions along the lateral border of the First rib. These divisions lie behind the clavicle, the Subclavius muscle and the Suprascapular vessels.

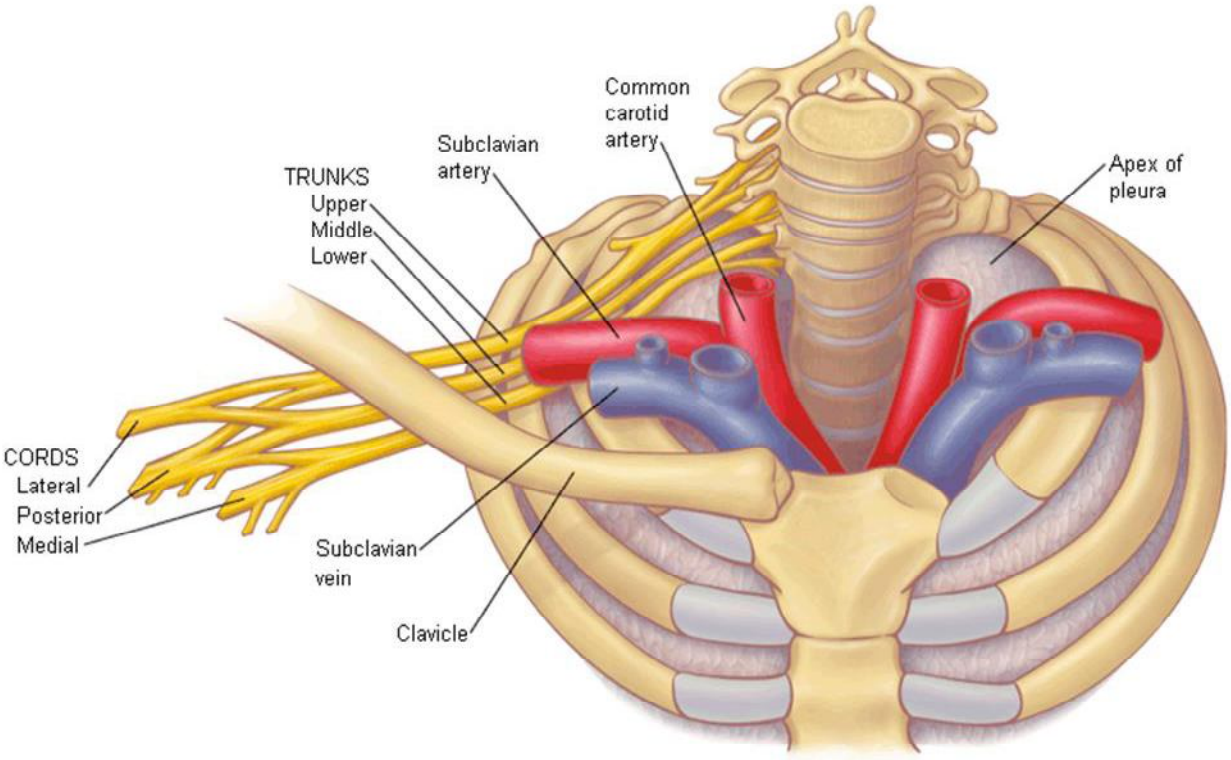
CORDS:

The cords are formed at the apex of axilla and are grouped around the axillary artery. Medial cord lies behind the artery, posterior and lateral cords lie lateral to the artery behind pectoralis minor muscle[9].

THE FIRST RIB:

The first rib lies in the horizontal plane slightly inclined downwards and forwards. The head articulates with the body of first thoracic vertebra and the upper surface has two transverse grooves 1. subclavian vein lies in the anterior groove and 2. the subclavian artery and lower trunk of brachial plexus lies in the

THE BRACHIAL PLEXUS AND ITS RELATION WITH FIRST RIB



posterior groove. Between the two grooves is the scalene tubercle where the scalenus anterior muscle is inserted. The outer border gives origin to serratus anterior. Importance of this first rib is it is kept as a guide to locate the plexus without puncturing the pleura.

THE PERIVASCULAR SHEATH :

As the roots emerge between the transverse processes of cervical vertebra,they are enclosed in a sheath which is a fibrofatty space. Anterior sheath arises from the anterior tubercles and covers the posterior surface of Scalenus anterior muscle. Posterior sheath arises from the posterior tubercles and covers the anterior surface of the Scalenus medius muscle. This sheath gives the CLICK feel if pricked by needle. This sheath is the most important factor in determining the success of blockade.

SYMPATHETIC SUPPLY

- C5 and C6 nerves receive grey rami from the middle cervical sympathetic ganglion
- C7 and C8 nerves receive grey rami each from the inferior cervical sympathetic ganglion and T1 ganglion.

PHYSIOLOGY OF NERVE CONDUCTION

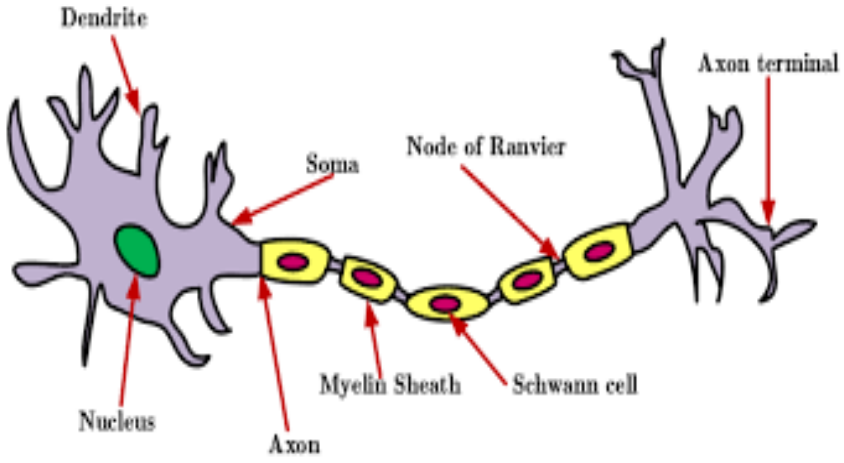
Neuron is the basic structural unit of the nervous system that responds to various stimuli. Neurons relay, integrate and transmit nerve impulse

Typical neuron consists of

1) **Soma or Cell body** : It is the body of neuron. It contains nucleus. Protein synthesis occurs here. The Nucleus is about 3 to 18 microns in diameter.
2) **Dendrites** : The dendrites of a neuron are cellular extensions with many branches. The overall shape and structure is referred metaphorically as a dendritic tree. This is where the majority of input to the neuron occurs via the dendritic spine.
3) **Axon** : The axon is a finer, cable-like projection that can extend tens or even tens of thousands of times the diameter of the soma in length. The axon carries nerve signals away from the soma (and also carries some types of information back to it). Many neurons have only one axon, but this axon may and usually will undergo extensive branching, enabling communication with many target cells. The part of the axon where it emerges from the soma is called the axon hillock.

All peripheral nerves are elongated axons of neurons.A typical peripheral nerve consists of bundles of motor, sensory, other fibres enclosed.

STRUCTURE OF NEURON



Outermost covering is called Epineurium. Inside the epineurium, the Perineurium surrounds the bundle collection. Innermost covering is called Endoneurium. Each nerve fibre is covered by a layer of neurilemma or axonal membrane.

Depending on the presence or absence of myelin sheath, it can be a myelinated or unmyelinated nerve fibre. Myelin sheath helps in faster conduction.

CLASSIFICATION OF PERIPHERAL NERVES

Erlanger and Gasser classified nerve fibers based on their diameter, conduction velocity and other electrical characteristics and functions. They are A, B, C groups and A group is subdivided into alpha, beta, gamma, delta fibers. A and B are myelinated and C fibers are unmyelinated. Fiber diameter decreases in order of A to C. The A alpha carry proprioception and motor sensation. The A beta fiber carry touch and pressure. The A gamma fibers are motor to muscle spindles. The A delta carry pain, cold and touch sensation.

The B fibers are preganglionic autonomic fibers. The C fibers are further subdivided into sympathetic sC fibers and dorsal dC fibers. Former carries various autonomic functions and the latter carry pain, warm temperature and touch.

NERVE CONDUCTION:

Axonal membrane is a bilipid membrane interspersed with large protein molecules.

Membrane lipids are phospholipids with polar head group and non polar hydrocarbon tail.

A membrane bound protein sodium potassium ATPase maintains normal resting membrane potential between -50 to -90 mv by pumping sodium ions out of the membrane.

When excitatory impulse reaches the neuron, it causes opening of Na channels and sodium ions move into the membrane causing rapid depolarization. This generates action potential and is transmitted along the axon to motor unit. Membrane potential returns back to normal resting membrane potential when Na and K channels close.

Local anesthetics(LA) are weak bases. Unionized form diffuses into the membrane and due to equilibirium, it becomes ionized. It is called "ion trapping". LA binds to receptor present in the innerpart of voltage gated Na channels and blocks Na conduction there by stopping action potential. It is a reversible block. LA have greater affinity for inactivated form of Na channels.

Nerve fibers differ in their sensitivity to local anaesthetics and are determined by the degree of myelination, axonal diameter and various other factors.

PHARMACOLOGY OF LOCAL ANAESTHETICS

Local anesthetics consist of a lipophilic group which is a benzene ring and a hydrophilic group which is a tertiary amine connected by an ester or amide linkage. Ester links are more prone to hydrolysis and hence have short duration of action. Local anaesthetics are weak bases. They are clinically available as salts for increasing their solubility and stability. They exist either as cation or an uncharged base. The pKa and pH of body fluids govern the relative proportion of the two forms which can be inferred from the Henderson and Hasselbalch equation. At physiological pH they are in charged cationic form which is active at the site of the receptor. But the uncharged form rapidly penetrates the biological membrane.

Based on the intermediate chain, the local anesthetics are classified as amides or esters. The physicochemical properties depend on the substitutions in the aromatic ring, intermediate chain linkage and alkyl group attached to amine nitrogen. The potency correlates with lipid solubility and as such lipid soluble drugs easily penetrate the cell membrane. The potency increases with increase in total number of carbon atoms in the molecule and is affected by myelination, size of fiber, pH, frequency of nerve stimuli and electrolyte concentration.

The onset of action depends on lipid solubility and the concentration of non-ionized and ionized fraction, which again depends on pKa. The pKa of

lignocaine and bupivacaine is 7.8 and 8.1 respectively. The pKa of a compound is defined as the pH at which the ionized and un-ionized forms are equal. The local anesthetics are prepared as water soluble hydrochloride salts with a pH of 6-7. The pH of local anesthetic solution with adrenaline is from 4 to 5 since it is unstable at a pH of 6-7. The carbonated solution of local anesthetic has shorter onset of action than hydrochloride salt since the nonionised fraction is more and penetrability is higher. The three major factors that determine the conduction-blocking profile of the local anesthetics are,

1.Lipid solubility - Local anesthetics which are highly lipid soluble are able to penetrate the neuronal membrane more readily which is reflected biologically in their increased potency.

2. Protein binding - Local anesthetic agents which bind readily to proteins and hence have prolonged duration of action.

3. pKa - Local anesthetics with pKa values close to physiological pH will have more rapid onset than those with higher pKa values.

PHARMACOKINETICS

Local anesthetics are weak bases that have a pKa value above the physiological pH. Hence <50% of local anesthetics exists as non-ionized state.

ABSORPTION

Absorption of local anaesthetic into systemic circulation is determined by factors such as dosage of the drug, drug-tissue binding, site of injection, use of vasoconstrictors (e.g, epinephrine), local tissue blood flow. Local anaesthetics are rapidly absorbed from highly vascular sites than poorly perfused tissues like tendon, subcutaneous fat and dermis. Epinephrine if added reduces absorption of local anaesthetics into the systemic circulation, from the site of injection by decreasing the blood flow in the areas where they are injected.

DISTRIBUTION

The amide types of local anaesthetics have wide volume of distribution after intravenous bolus administration. They have the property to get deposited in lipophilic storage sites such as fat. The initial phase is the rapid distribution phase, that includes uptake into organs which are highly perfused such as the heart, liver, brain and kidney, followed by a slow phase of distribution where there is uptake into organs which are moderately perfused such as gastrointestinal tract and muscle.

Tissue/blood partition coefficient:

Lipid solubility is responsible for the rapid uptake of local anesthetic whereas protein binding is responsible for their longer duration of action.

Tissue mass: Muscle is the greatest reservoir for local anaesthetics.

METABOLISM AND ELIMINATION:

Esters are metabolised by Plasma cholinesterase. Procaine and benzocaine are metabolized to p-aminobenzoicacid which is allergic.

Amides are metabolized in liver by microsomal P-450 (N-dealkylation and hydroxylation). In cirrhosis of liver, congestive cardiac failure, the dosage of bupivacaine and other amides should be reduced.

PHARMACODYNAMICS:

MECHANISM OF LOCAL ANAESTHETIC ACTION:

The local anaesthetics exert their action by blocking the voltage gated sodium (Na) channels. The neuronal cell membrane maintains a resting transmembrane potential of –90 to –60 mV and hence during excitation phase, the sodium channels are opened leading to fast influx of Na+ current which depolarizes the membrane quickly toward the sodium equilibrium potential (+40 mV). As a result of this depolarization the sodium channels close or get inactivated and potassium channels open and the outward flow of K+ repolarizes the membrane toward the potassium equilibrium potential (about –95 mV) then the sodium channels return to the rested state during repolarization process that determines the refractory period. The trans membrane ionic gradients are maintained by sodium pump.

Local anaesthetics block the sodium channels from the interior in a voltage and a time dependant fashion. The activated or open state and the inactivated states have more affinity than rested state.

Effects on organ system:

A.Central nervous system:

Early symptoms of CNS toxicity include circumoral numbness, paresthesia of tongue, dizziness, tinnitus and blurred vision, restlessness, agitation, paranoia, nervousness, slurred speech, drowsiness, seizures, unconsciousness. Initially excitatory symptoms occur and later inhibitory symptoms occur.

B. Respiratory system:

Causes relaxation of bronchial smooth muscles. Apnea occurs due to depression of medullary center of respiration.

C. Cardiovascular system:

Depression of myocardial automaticity, conduction and contractility occurs. The dose required to produce cardiovascular toxicity is three times than that of central nervous system toxicity. They produce tachycardia, hypertension(cocaine) or hypotension, atrio-ventricular block, arrhythmia, ventricular tachycardia and ventricular fibrillation.

D. Immunological:

The preservative Methylparaben present in local anesthetic mixtures inhibit the inflammatory response that activates the neutrophils by lysophosphatidic acid. Allergic reactions occur due to the formation of para-aminobenzoic acid when the ester type of local anesthetics are used.

E. Musculoskeletal system:

Local anaesthetics are myotoxic, so necrosis can occur on intramuscular injection.

F. Hematological:

Lignocaine decreases coagulation and enhances fibrinolysis.

Drug interaction:

The local anaesthetic action is potentiated by succinyl choline, opioids, alpha adrenergic agonist, cimetidine, propranolol, sodiumbicarbonate and potassium.

TREATMENT OF SYSTEMIC TOXICITY:

If symptoms of local anesthetic systemic toxicity (LAST) occur

1) Prompt airway management
2) If seizures occur, benzodiazepines can be used, if not controlled, small doses of propofol or thiopentone can be used.
3) If cardiac arrest occurs, standard ACLS with modifications should be used

a) If epinephrine is used, smaller doses (10-100 mcg) are preferred

b) Vasopressin is not recommended

c) Avoid calcium channel blockers or beta blockers

d) If ventricular arrhythmias develop, Amiodarone is preferred

4) Lipid Emulsion Therapy :

- Administration at the first signs of LAST after airway management

- Dosing: - 1.5 ml/kg 20% lipid emulsion

THEORIES OF LOCAL ANAESTHETIC ACTION:

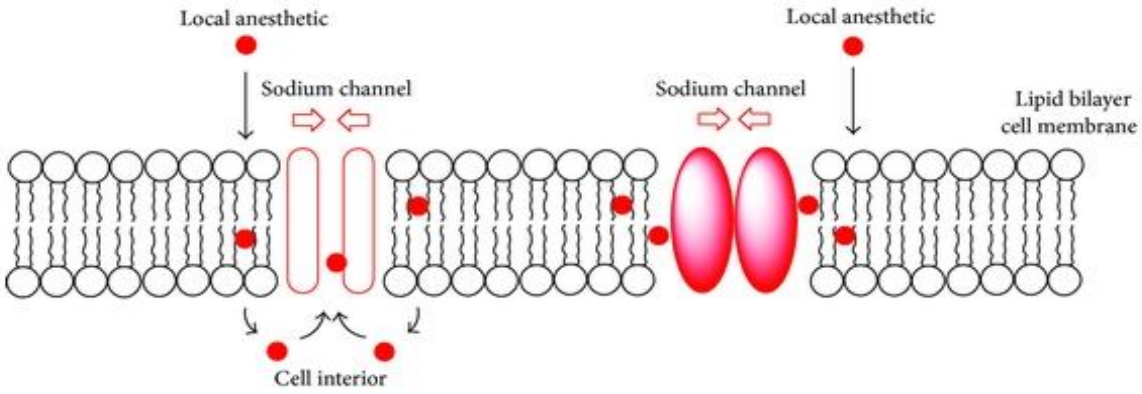
According to the "CORE MANTLE EFFECT'' the nerves within a plexus are not arranged randomly, those nerve fibers supplying the distal structures in its territory lie at the center or core whereas those supplying the proximal areas are in the outer layer or mantle. In most mixed peripheral nerves the proportion of motor and sensory fibers is same in both the mantle and the core but this is not the case with brachial plexus. Large proportion of core fibres are those providing rich sensory innervation to hand and mantle fibers are predominantly motor to shoulder and elbow. The first sign of successful brachial plexus is weakness of either shoulder or elbow joint.

ACTION POTENTIAL:

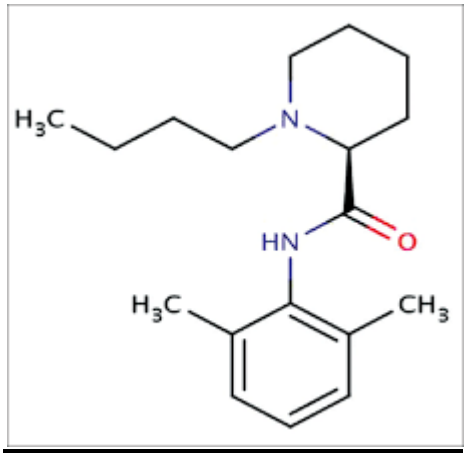
The neurons have voltage-gated sodium and potassium channels that respond to chemical, mechanical and electrical stimuli by depolarization that occurs at –55mV, leading to influx of Na+ions and generate action potential and conducts the impulse via nerve axon. The increase in Na+ ions intracellularly causes a reversal of membrane potential to +35mV. Subsequently a rapid decrease in sodium permeability occurs along with an increase in K+ conductance through voltage gated potassium channels so that more potassium exits from the cell rendering the cell to return to a resting state. The Na+ channels have one α subunit and one or two β subunits. The beta subunit is smaller and the alpha subunit is larger. The voltage gated sodium channels exists in three states - they are resting, activated and inactivated state. The local anesthetics bind to α subunit and block the voltage gated Na + channel from inside the cell.

The local anesthetics have affinity to activated and inactivated state of sodium channel and not to the resting state and hence they are voltage and time dependent. The potassium, calcium and NMDA receptors are also blocked by local anesthetics. Drugs like Amitriptyline, Ketamine, mepiridine and Volatile anesthetics blocks the sodium channels. Tetrodotoxins also bind to sodium channel.

MECHANISM OF ACTION OF LOCAL ANAESTHETIC



STRUCTURE OF LEVOBUPIVACAINE



PHARMACOLOGY OF LEVOBUPIVACAINE

Levobupivacaine is an amide type local anaesthetic agent with long duration of action. It blocks nerve conduction in the sensory and motor nerves largely by interacting with voltage sensitive sodium channels on the cell membrane, but potassium and calcium channels are also blocked. Levo-bupivacaine interferes with transmission of impulse and conduction in other tissues.

The dose of Levobupivacaine is expressed as base. There is around 13% more active substance in Levobupivacaine solutions when compared to bupivacaine. Levobupivacaine is equipotent with bupivacaine.

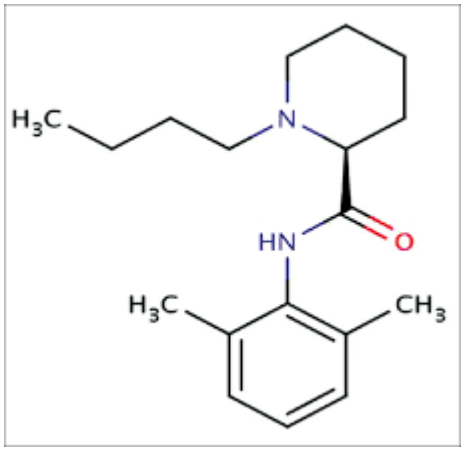
Pharmacokinetics

The plasma concentration of Levobupivacaine following therapeutic administration depends on dose and route of administration as, absorption from the site of administration is affected by vascularity of tissue. Plasma protein binding of levobupivacaine is > 97% at concentrations between 0.1 and 1.0 mcg/ml. Levobupivacaine is metabolized extensively. Unchanged Levobupivacaine is not excreted in urine. 3-hydroxylevobupivacaine is a major metabolite of Levobupivacaine. It is excreted in the urine as glucuronic acid and sulphate ester conjugates. Metabolism is CYP3A4 mediated. Metabolites of Levobupivacaine are desbutyl – Levobupivacaine and 3-bydroxylevobupivacaine. Following

intravenous administration,is found in urine 71%is found in urine and in faeces 24% in 48 hours.

The mean total plasma clearance of Levobupivacaine is 39 litres/hour , half-life 1.3 hours, and volume of distribution is 67 litres.

STRUCTURE OF LEVOBUPIVACAINE



MECHANISM OF ACTION

Local anaesthetics such as levobupivacaine blocks the generation and the conduction of nerve impulses, presumably by increasing the threshold for electrical excitation in the nerve, by slowing the propagation of nerve impulse and by reducing the rate of increase of the action potential. In general,the progression of anaesthesia is related to the diameter, myelination and conduction velocity of affected nerve fibres. Specifically, the drug binds to the intracellular portion of

sodium channels and blocks sodium influx into the nerve cells, which prevents depolarisation.

DOSE

Peripheral nerve block (adults) - 2.5-5.0 mg/ml concentration. maximum dose 150 mg.

PHARMACOKINETICS

Absorption from the site of administration is affected by the vascularity of the tissue. Doses upto 150 mg results in mean C_{max} levels of upto 1.2µg/ml

Volume of distribution - 67 litres

Protein binding - >97%

Half life - 3.3 hours

Clearance - 39.06 ± 13.29 lit/hour

Metabolism:

The 3 - hydroxy levobupivacaine metabolise into glucoronide and sulfate conjugates. Metabolic inversion of Levobupivacaine to R (+) bupivacaine was not evident both invitro and invivo.

Toxicity:

Levobupivacaine appears to cause less myocardial depression than both bupivacaine and ropivacaine inspite of higher concentrations.

PHARMACOLOGY OF LIGNOCAINE HYDROCHOLORIDE

Lignocaine was synthesized in 1943 in Sweden by Lofgren. It is chemically a tertiary amide, diethyl aminoacetyl, 2.6, xylidine hydrochloride monohydrate. It is a local anaesthetic of moderate potency and duration but of good penetrative power and rapid onset of action. It is a stable compound at room temperature.

MECHANISM OF ACTION:

Lignocaine prevents transmission of nerve impulses by inhibiting passage of sodium ions through ion-selective sodium channels in the nerve membranes. This slows the rate of depolarization such that the threshold potential is not reached and thus action potential is not propagated. But resting membrane potential is not altered.

PHARMACOKINETICS

Molecular weight: 271 Pka : 7.8

Protein binding: 70%

Lipid solubility: 2.9

Volume of distribution: 91 liters

Clearance: 0.95 litres / minute

Elimination half life : 96 minutes

Toxic plasma concentration: >5 microgram /ml

METABOLISM:

The principle metabolic pathway of Lidocaine is oxidative dealkylation in Liver to monoethylglycine xylilide followed by hydrolysis of this metabolite to xylidide. Hepatic disease can decrease the rate of metabolism of Lidocaine.

Dose: Safe dose: 3mg/kg without adrenaline 7mg/kg with adrenaline Adrenaline up to *5µgm /ml (1in 2,00,000) dose not give rise to systemic effects*.

TOXICITY

Allergic reactions: Due to the methyl paraben or similar preservatives that are structurally similar to para aminobenzoic acid, allergic reactions are due to antibody stimulation by the preservative.

Central nervous system: Numbness of tongue and circumoral tissues, restlessness, vertigo, tinnitus slurred speech skeletal muscle twitching, tonic clonic seizures (produced by selective inhibition of the inhibitory neurons of central nervous system leaving unopposed excitatory neuron activity), central nervous system depression, hypotension, apnoea. transient radicular irritation (with 5% hyperbaric lignocaine) Cauda equina syndrome.

Cardiovascular System: Plasma concentrations 5-*10µgm/ml can produce* profound hypotension due to relaxation of arteriolar smooth muscle and direct myocardial depression.

Therapeutic uses:

1. Topical anaesthesic (2-4%)

2. EMLA Cream (Lignocaine 2.5% with Prilocaine 2.5%)

3. Local infiltration and peripheral nerve block

4. Intravenous regional anaesthetic (Biers block)

5. Regional anaesthetic (Spinal / epidural)

6. Stress attenuation and prevention of rise in intra cranial tension

7. Suppression of the ventricular arrhythmias.

8. Reflex induced bronchospasm is also attenuated by intravenous administration of lignocaine

9. Used intravenously as an analgesic for certain chronic pain states

10. Used as a supplement to general anaetheisa.

Contraindications:

1) Hypersensitivity

2) Stokes Adams syndrome, severe degree of heart block

ADRENALINE (Epinephrine):

Adrenaline, a sympathomimetic drug used in 1 in 2,00,000 concentrations *(5 µgm/ml) added to local anesthetics to reduce vascular absorptio*n and local anaesthetic toxicity. Duration of both sensory and motor blockade is increased by addition of adrenaline to lignocaine but, only sensory block is prolonged if

adrenaline is added to bupivacine with no effect on motor blockade. Adrenaline should not be used in

1. Ring block of fingers, toes, penis, pinna and nose.
2. Mycocardial ischemia patient.
3. Severe hypertensives.
4. Hyperthyroid patient.
5. Intravenous regional anaesthesia (Bier‘s block).

HISTORY OF BRACHIAL PLEXUS BLOCKADE

The invention of many techniques and safer drugs has made the anaesthesia practice very easy and safer in the perioperative period .It is essential to know about the history and evolution of techniques.

- **Friedrich Gaedcke** chemically isolated cocaine which is the most potent alkaloid of the coca plant, during 1855.Gaedcke named it as "erythroxyline".
- In the year 1860 **Niemann** extracted cocaine from coca leaf.
- **Sigmund Freud** introduced Cocaine to Koller.
- In the year 1884, the Austrian ophthalmologist **Carl Koller** experimented on a 2% solution of cocaine by instilling it into his own eyes and tested its effectiveness as a local anesthetic by pricking the eye with needles.
- In 1889, **William Halstead** deposited cocaine to brachial plexus by using surgical approach
- In 1892, **Carl Schleich** (1859-1922) introduced the technique of infiltrating dilute concentrations of local anaesthetic solution as an alternative to direct injection of nerve trunks (0.01%-0.2%)
- In 1897, **George Crile** introduced the technique of surgical exposure of the nerve roots and infiltrating each nerve directly
- In January 1900, **Harvey Cushing** (1869–1939) one of Halsted's surgical residents, applied cocaine to brachial plexus prior to dividing it, for sarcoma

excision. He coined the term **REGIONAL ANAESTHESIA** in the year 1902

- In 1911, **Diedrich Kulenkampff** (1880-1967) performed the first percutaneous brachial plexus block. In his study Kulenkampff placed the needle superficial to the first rib and pleura. He injected only 10 ml of local anaesthetic solution - procaine into his own plexus at the mid-clavicular position lateral to subclavial artery.
- In 1911, **George Hirschel** (1875-1963) performed the first brachial plexus block through axilla.
- **Leonard Corning** (1862-1934), a neurologist placed tourniquet which could prolong the analgesic effect by preventing blood from removing the local anaesthetic from its active site.
- **Henrich F.Braun** (1862-1934) added Epinephrine to prolong the effect of cocaine which was described as CHEMICAL TOURNIQUET‘.
- In 1905, **Braun** introduced Procaine which is less toxic than cocaine.
- In 1917, **Bazy** and **V.Pauchet** described the infraclavicular approach to brachial plexus block which was later popularized by **P.Raj** in 1973.
- In 1946, **F.Paul Ansbro** performed continuous brachial plexus block.
- Interscalene approach of Brachial plexus block was introduced by **Alon P.Winnie** in 1907. He emphasized that scalene muscles are more accurate

landmark than subclavian artery or midclavicular portion to locate the brachial plexus block.

- In 1905, **Alfred Einhorn** synthesized procaine and in 1930‘s long acting drugs like Tetracaine and Dibucaine were synthesized. In 1943, **Lofgren** and **Lundqvist** synthesized Lignocaine. In 1952 chloroprocaine was synthesized. In 1957 Mepivacaine was synthesized. Bupivacaine was synthesized in 1963 by **Ekenstam** and **Telivuo** introduced bupivacaine in to clinical practice. In 1996, Ropivacaine was synthesized.

It was **Luigi Galvani** who first demonstrated that an electrical charge would result in an electrical stimulation and hence muscular contraction in the year 1780.

In the year 1850 Von Helmholtz did many experiments with isolated nerve and muscle preparations. It was **Perthes** who used electrical stimulation using a peripheral nerve stimulator which had a nickel-insulated needle to locate the brachial plexus in the year 1912. **Pearson** successfully demonstrated the technique of electrically stimulating the motor nerves with the help of an insulated needle in the year 1955. In 1962 a portable nerve stimulator was devised by **Greenbatt and Denson**. In 1969, **Magora** determined that a suitable threshold for stimulating obturator nerve was 0.5mA. He used an electrical stimulator with an ammeter. The idea of nerve stimulation was reintroduced by **Raj et al** in the year 1980

TECHNIQUES OF BRACHIAL PLEXUS BLOCK

The various approaches are

1) INTERSCALENE BLOCK

   a) Anterior approach-

      i) Winnie

      ii) Modified lateral approach of Borgeat

      iii) Meier

   b) Posterior approach

      i) Kappis or pippa

      ii) Boezaart

2) SUPRACLAVICULAR BLOCK

   a) Classic approach of Kulenkampff

   b) Plumb bob technique

   c) Subclavian perivascular technique of Winnie and Collins

   d) Modified lateral perivascular approach of moorthy

3) INFRACLAVICULAR BLOCK.

   a) Vertical infra-clavicular approach

   b) Coracoid technique

   c) Raj technique

SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

SUBCLAVIAN PERIVASCULAR APPROACH

4) AXILLARY BLOCK

a) Trans arterial injection

b) Paresthesia technique-i)single injection & ii)multiple injection"[9]

SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK:

1)CLASSICAL APPROACH OF KULENKAMPFF

"In this technique, needle is inserted 1 cm posterior to mid point of clavicle. 22G Needle is inserted parallel to the patient neck and head. Needle is directed caudad and posterior until First rib is encountered at 4 to 5 cm. Needle is walked over the rib until paresthesia is elicited, local anesthetic is injected after careful aspiration for blood or nerve locator can be used to find the plexus.

2)PLUMB BOB TECHNIQUE :

Needle entry inserted at an angle of 90 degrees at the lateral border of sternocleido- mastoid muscle where it inserts into clavicle. Paresthesia is sought and local anesthesia is injected.

3)SUBCLAVIAN PERIVASCULAR TECHNIQUE OF WINNIE AND COLLINS

This is the most commonly used technique. Interscalene groove is identified and traced to its lowest level where it is posterior to the subclavian pulse. Then needle is directed just above and posterior to the subclavian artery until paresthesia

is noted. Then local anesthetic is injected carefully after aspiration or alternatively nerve stimulator can be used to evoke contractions of the muscles of the arm and forearm and local anesthetic is injected. In this study the subclavian perivascular technique is used with nerve stimulator guidance.

COMPLICATIONS :

1) Pneumothorax
2) Inadverdent arterial puncture.
3) Horners syndrome
4) Phrenic nerve palsy
5) Hematoma formation
6) Nerve injury

INFRACLAVICULAR BLOCK :

Advantages:

1. Simple to learn
2. High success rate
3. Tourniquet tolerance is good
4. Patient position is comfortable
5. Blocks musculo-cutaneous and axillary nerves

1) VERTICAL INFRACLAVICULAR BLOCK(CLASSICAL APPROACH)

This technique is used for surgeries below elbow and forearm. This block is performed at the level of cords. Needle is inserted 1 cm below the midpoint of clavicle and is directed laterally towards coracoid process or humeral head till paresthesia is elicited. Then local anesthetic is injected after careful aspiration

COMPLICATIONS:

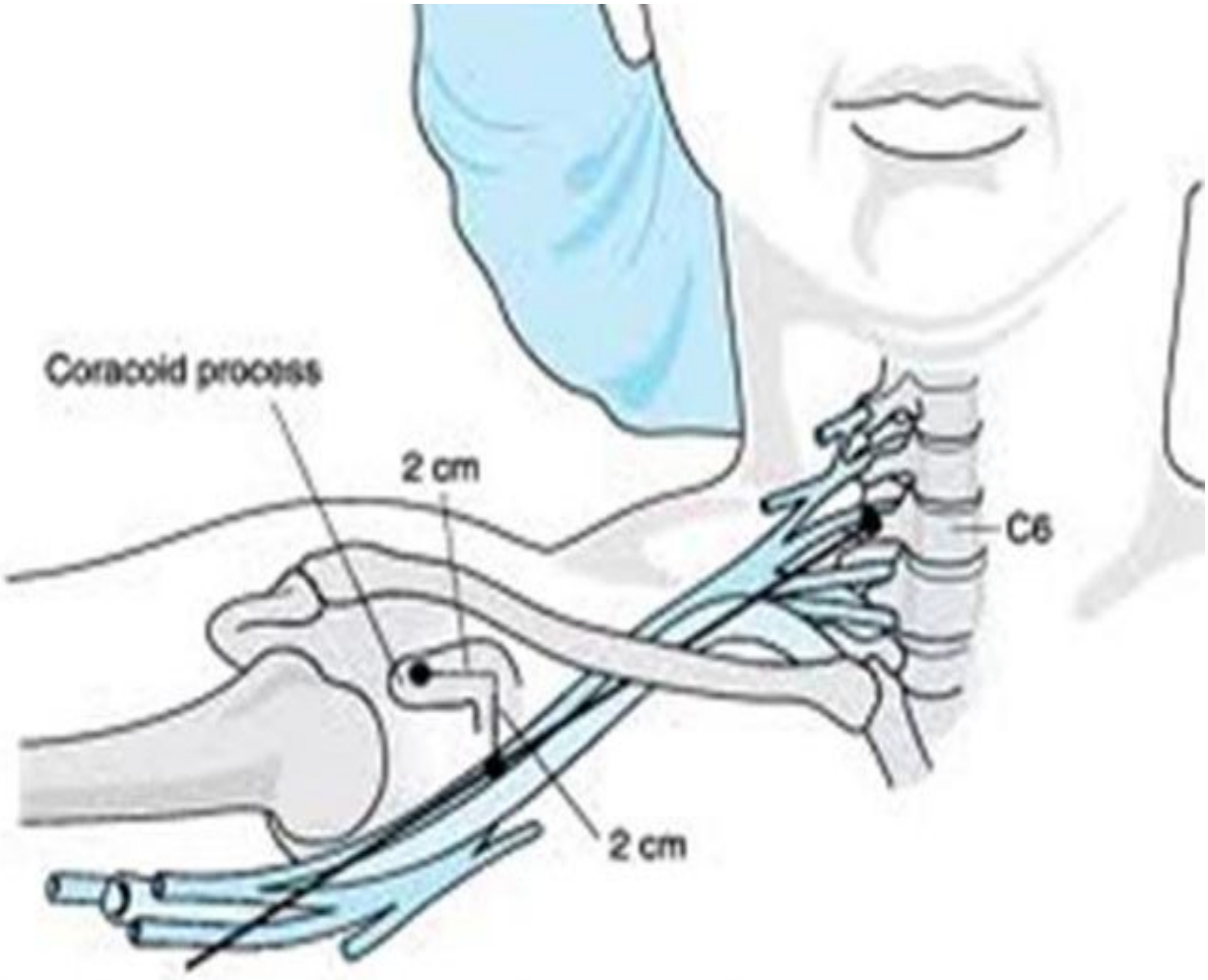
1) Pneumothorax
2) Hematoma
3) Nerve injury

1) CORACOID TECHNIQUE

The needle insertion site is 2cm medial and 2 cm caudad to coracoid proces. This technique is used in this study under nerve stimulator guidance . There is minimal chance of pnemothorax in this technique. It offers early and complete blockade and avoids complications of supraclavicular blockade"[9].

INFRACLAVICULAR BRACHIAL PLEXUS BLOCK

CORACOID APPROACH



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PRINCIPLES OF NERVE STIMULATOR

"The peripheral nerve stimulation for nerve block involves the use of a peripheral nerve stimulator, which is the direct current (DC) square-wave impulse generator and supplies a constant electrical current. The frequency (Hz), amplitude (mA), and pulse duration (ms) can be adjusted in order to assist in location of mixed motor/sensory, motor nerves.

Depolarization of the nerve depends on many factors like

a) The distance from the electrical field generated at the tip of the stimulating microelectrode needle

b)The electrical charge

c) The stimulation threshold of the targeted nerve.

Depolarization and the resulting action potentials will elicit a motor response and movement with varying intensity.

The peripheral nerve stimulator (PNS) consists of four main components:

1) an oscillator

2) a constant current generator

3) capabilities to control stimulus, intensity, duration, and frequency

4) a display.

Modern stimulator involves a microprocessor which is programmed to control all these parameters and ensure their accuracy. These are constant current

generators that ensure accurate delivery of a constant current in the face of changes in electrical impedance that occur between anode and cathode.

Electrical charge which is applied to the nerve is a product of current amplitude (mA) and pulse duration (millisec). The threshold for stimulating a nerve is quantified by rheobase and chronaxie. The RHEOBASE of a nerve is the lowest current amplitude with long or indefinite pulse duration applied to depolarize a nerve and CHRONAXIE is the pulse duration at which the threshold current amplitude is twice that of the rheobase. A pulse duration of no longer than the chronaxie is desired because current consumption is increased without decreasing the threshold significantly.

The formula $I = Ir (1 + C/t)$ here, I Is the current amplitude, Ir - rheobase, C -chronaxie, and t - pulse duration, It shows that the current amplitude necessary for nerve stimulation depends on the pulse duration of the stimulus.

Nerve Localization: Nerve localization is achieved by following the surface landmarks which have been widely published and underlie the various techniques used for regional anesthetic blocks. Following identification of landmarks the block needle is used to search for a distinct endpoint with the objective of putting the needle tip in the immediate vicinity of the targeted nerve or nerves.

Two categories of endpoints exist they are 1. Anatomical endpoint 2. Functional end point.

1) Anatomical endpoint: It is dependent on intimate anatomical relationships of other structures to the targeted nerve or nerves. Examples are transarterial or periarterial techniques for blocks including brachial plexus, the use of imaging like ultrasonography.

2) Functional endpoint: It requires neural function ie, a neural response to mechanical or electrical stimulation. The two major functional endpoints used in clinical practice include: 1) Sensory response to mechanical stimulation (i.e., paresthesia) and 2) Motor response to electrical stimulation (i.e., a muscular twitch).

In recent years, the use of motor responses to electrical stimulation has dominated the field of regional anesthesia. The major difference between paresthesia technique and motor response to electrical stimulation is that the latter is a graded phenomenon that yields information about nerve location from a distance, whereas the former is an all-or-none phenomenon requiring contact with the nerve.

Use of a Peripheral Nerve Stimulator: Peripheral nerve stimulators use an oscillating rectangular wave current generator. By alteration of the time base on an oscilloscope, these waves are graphed as square-waves, hence nerve stimulators are referred as square-wave generators. These square waves otherwise called

—*pulses* are programmed to occur at a given frequency, of around 1 to 2 Hz (1 to 2 cycles/sec).

Nerve stimulators of recent times are constant current generators which deliver accurate pulses of electrical current even in the presence of varying tissue impedances (resistances, capacitances, and inductances). They are capable of producing electrical pulses of accurate duration in the 0.1 to 1.0 ms range and are capable of continuously and accurately controlling electrical current amplitude in the range of 0 to 5 mA. So with the use of modern peripheral nerve stimulators, following variables are controlled during nerve location: a) Pulse frequency b) Current amplitude (amperage) c) Conductive area of electrode d) Pulse duration and e) Electrical impedance in tissues"[39]

APPROACHES USED IN THIS STUDY

SUPRACLAVICULAR BLOCK

TECHNIQUE

With the patient in supine position head turned to opposite side the Interscalene groove is identified and traced to its lowest level where it is posterior to the subclavian pulse.

"The nerve stimulator is connected to the needle and set to deliver a 1.5mA current at 1 Hz frequency and 0.1 ms of pulse duration.

The needle is inserted first in an anteroposterior direction, almost perpendicularly to the skin with a slight caudal orientation. The needle is gradually advanced until the upper trunk is identified by observing muscle twitch of the shoulder muscles or if there is no response, advance 1 cm further. At this point, the orientation of the needle is changed to advance it now caudally under the palpating finger, with a slight posterior angle. This strategy directs the needle from the vicinity of the upper trunk (shoulder twitch) to the front of the middle trunk (biceps, triceps, pectoralis twitch) on its way to the lower trunk (fingers twitch).

The goal of this block is to bring the tip of the needle in the proximity of the lower trunk, which is manifested by a twitch of the fingers in either flexion or extension.

SUPRACLAVICULAR APPROACH

Once the elicited motor response of the fingers is obtained at 0.5 mA, the injection of local anaesthetic mixture 20 ml of 0.5%levobupivacaine and 10cc of 2% lignocaine with adrenaline is carried out after gentle aspiration. Injecting in the proximity of the lower trunk (motor response of the fingers) is the most important factor in accomplishing a successful supraclavicular brachial plexus block.

TROUBLESHOOTING MANEUVERS

1. If the needle in its first perpendicular insertion does not make contact with the upper trunk
    - Verify that the nerve stimulator connections and settings are correct
2. Failure to elicit a muscle twitch from the middle and lower trunks after eliciting a twitch from the upper trunk
    - This usually means that the orientation plane of the needle, which is advancing caudally, does not match the frontal orientation plane of the trunks. Bring the needle back to the vicinity of the upper trunk (shoulder twitch) and increase the posterior orientation of the needle a few degrees.

INFRACLAVICULAR APPROACH

TECHNIQUE

With the patient in supine position with the arm adducted and elbow flexed over abdomen coracoid process of the side to be blocked is identified. 2 cm below and medial to coracoid process is the needle insertion site.

The needle insertion site is infiltrated with local anesthetic using a 25-gauge needle. Local anesthetic should also be infiltrated deeper into the pectoralis muscle to decrease discomfort during needle insertion through the muscle layers.

A 10-cm, 22-gauge insulated needle, attached to a nerve stimulator, is inserted at a 45^{o} angle to the skin and advanced parallel to the line connecting the medial clavicular head with the coracoid process. The nerve stimulator is initially set to deliver 1.5 mA. A local twitch of the pectoralis muscle is typically elicited as the needle is advanced beyond the subcutaneous tissues. Once these twitches disappear, the needle advancement should be slow and methodical while the patient is observed for motor response of the brachial plexus.

TROUBLE SHOOTING

- When the pectoralis muscle twitch is absent despite an appropriately deep needle insertion, the landmarks should be checked because the needle has most likely been inserted too cranially (underneath the clavicle).

INFRACLAVICULAR CORACOID APPROACH

- Twitches from the biceps or deltoid muscles should not be accepted because the musculo-cutaneous or axillary nerve may exit the brachial plexus sheath before the coracoid process. Injection of local anesthetic outside the sheath would result in a weak block of slow onset.
- Hand stabilization and precision are crucial in this block because the tissue sheath separating the brachial plexus from the pectoralis minor muscle is thin at this location. Small movements of the needle may result in injection of local anesthetic outside the sheath and within the muscle.
- After the twitches of the pectoralis muscle cease, the stimulating current should be lowered to < 1.0 mA to decrease patient discomfort. The needle is then slowly advanced or withdrawn until hand twitches are obtained at 0.2 to 0.5 mA.
- The success rate with this block decreases when local anesthetic is injected after obtaining stimulation with a current intensity >0.5 mA.

The goal is to achieve a hand twitch (ideally finger extension) using a current of 0.5 mA."[21]

REVIEW OF LITERATURE

"To study the phenomenon of disease without books is to sail in uncharted sea, while to study books without patients is not to go to sea at all"

– Sir William Osler

In the year 2010 ***Chun woo yang et al***[7] compared supra clavicular(plumb bob technique) and infraclavicular blocks(vertical infraclavicular block) in 100 patients with 30 ml of 0.5% ropivacaine. In this study they had observed which nerve type was stimulated, and had scored the sensory and motor block. The quality of the block had been assessed intra-operatively. The duration of the sensory and motor block as well as the complications had also been assessed and had concluded that there was no significant difference in sensory block evolution, motor block evolution, quality of blockade. There were no significant differences in the duration of the sensory and motor block. There was a significant difference in the incidence of Horner's syndrome. Two patients had reported pneumothorax in the supraclavicular approach

Alan Macfarlane et al [1]in the year 2009 had studied infraclavicular blocks under nerve stimulator guidance and had reported that complications are less in pericoracoid approach compared to vertical infraclavicular block which has a high success rate from single injection using a nerve stimulator, but has potentially

serious complications such as phrenic nerve palsy (25%) and pneumothorax (0.7%).

Pericoracoid infraclavicular blocks require multiple injections with a nerve stimulator or ultrasound guidance to verify adequate local anaesthetic spread posterior to the axillary artery to be successful. Infraclavicular blocks might take 30 min before surgery could commence.

Another study was performed by ***Vikram Uday Lahori et al***[43] in the year 2011. They compared the vertical infraclavicular approach (VIB) in 30 patients and axillary approach in 30 patients using a peripheral nerve stimulator. Sensory block in the distribution of individual nerves supplying the arm, motor block, duration of sensory block, incidence of successful block and various complications had been recorded. Successful block had been achieved in 90% of the patients in group I and in 87% of patients in group A. Intercostobrachial nerve blockade was significantly higher in group I. No statistically significant difference had been found in sensory and motor blockade of other nerves. They had concluded that the vertical infraclavicular block because of its easily identifiable landmarks, a comfortable patient position during the block procedure and the ability to block a larger spectrum of nerves should thus be considered as an effective alternative to the axillary approach.

Yavuz Gurkan et al [48]reported mean duration of analgesia of 13 ± 8 h and a mean duration of motor block of 6 ± 2 h using 30 ml of LA mixture (20 ml of levobupivacaine 0.5% and 10 ml of lidocaine 2% in infraclavicular blocks.

Zaharai DT et al[49] described the use of a nerve stimulator which facilitates accurate nerve blocks and causing no paraesthesia and reduces the possibility of nerve injury

Bashein G et al and Ford DJ et al[4] in their studies concluded that, in nerve stimulator assisted nerve blocks, insulated needles are more useful in precise location of peripheral nerves

Dureja et al[13]in the year 2016 had compared supra clavicular block using USG, nerve stimulator and conventional blind procedures in 90 patients, 30 patients in each group and concluded that the incidence of complications such as vessel puncture was seen only in conventional blind group. Comparison of blockade characteristics between the CB, NS, and US-guided groups revealed that the procedural time and number of skin punctures were nonsignificant in all the three groups. The onset of sensory and motor blockade was significantly less in US group compared to other groups. The mean duration of analgesia was significantly higher in both NS and US groups compared to CB group. The incidence of patchy effect and blockade failure requiring general anesthesia was significantly higher in CB group (13.3%) compared to NS group (10%) and US group (3.3%).

In a study of 26 patients conducted by ***Thrivikrama padur tantry***[41] in the year 2015 the motor response during brachial plexus block anesthesia was observed and concluded that sparing of ulnar nerve often leads to the failure of the upper limb blockade. Other than finger flexion, the wrist flexion the forearm twitches, pronation and wrist adduction may be used for lower trunk blockade. The patients with intact anatomical upper limb structures underwent (a) combined ultrasound (USG) assisted nerve stimulator evoked motor response evaluation or in (b) open brachial plexus trunk stimulation evaluations. The individual patient's lower trunk stimulation motor responses were documented.

When combined the results of both USG and open plexus groups, wrist flexion was seen in 52%, finger flexion in 61% and forearm pronation or twitches of anterior compartment in 48% of total subjects studied. These responses were noted either separately or in combinations and concluded that other than finger flexion, the wrist flexion the forearm twitches, pronation and wrist adduction may be used for lower trunk blockade and thus for higher accuracy.

Ilham c et al[22] performed supraclavicular block and compared 0.5% bupivacaine and 0.5% levobupivacaine in 60 patients in the year 2014. According to them motor and sensory block onset times in Group B were significantly shorter than Group L ($p < 0.05$). The mean time for first postoperative analgesic demand were 16.6 ± 8.0 h in Group B and 14.4 ± 7.3 h in Group L ($p > 0.05$). they

concluded that 30 ml 0.5% bupivacaine and levobupivacaine provide similar block characteristics for supraclavicular block. Bupivacaine leads to faster motor and sensory block onset compared to levobupivacaine, however had similar duration of postoperative analgesia.

MATERIALS AND METHODS

This study was carried out in orthopedic surgeries at Kanyakumari government medical college hospital, after gaining approval of the Medical Ethics Committee and written informed consent from the subjects. 60 consecutive patients who are of ASA physical status 1 & 2, 18 years of age or older, and scheduled to undergo surgery of the elbow, forearm, or hand under regional anesthesia were included.

STUDY DESIGN

Prospective randomized study.

DURATION OF STUDY

6 months

SAMPLE SIZE

This is a prospective randomized study to compare supraclavicular and infra-clavicular blocks under nerve stimulator guidance To find the required sample size for this Study, a Pilot Study was conducted with 10 cases in each of these two Groups. In the Pilot Study, the following results were obtained for onset of sensory block.

Supraclavicular group	=	13.46 ± 2.33 minutes
Infra-clavicular group	=	8.03 ± 4.63 minutes
S.D. for total cases	=	4.53 minutes

Using these figures, the sample size for this study was calculated with the following formula.

The sample size $n = \frac{2 \times \{z_{(1-\alpha/2)} + z_{(1-\beta)}\}^2}{\Delta^2}$

where $z_{(1-\alpha/2)}$ is the alpha error whose value for significance level of 1% (confidence level of 99 %) , is 2.5758 and $z_{(1-\beta)}$ is the beta error or power of the study whose value for power of 95% is 1.6449 and

Δ = $\frac{\text{Difference in means}}{\text{S.D}}$

= $\frac{13.06 - 8.03}{4.53}$

= 1.11

Alpha error at 1% significance level = 2.5758

Beta error (power) at 95 % = 1.6449

Sample size n = $\frac{2\,(2.5758 + 1.6449)^2}{1.11^2} = \frac{2(4.221^2)}{1.23}$

= $\frac{35.63}{1.23}$

= 28.97 rounded off to 30

The required sample size is 60 (2x30) cases for a significance level of 1% (confidence level of 99%) and power of 95% .

STATISTICAL TOOLS:

The information collected regarding all the selected cases were recorded in a Master Chart(excel sheet). Data analysis was done with the help of computer using **SPSS statistical package- Version 17.**

Using this software, measures of central tendency, measures of dispersion, 't' value, chi square and 'p' values were calculated. Un paired 't' test was used to test the significance of difference between quantitative variables and Yate's and Fisher's chi square tests for qualitative variables. A 'p' value less than 0.05 denotes significant relationship.

GROUPS:

The patients were randomized to receive either a Infraclavicular plexus block (group I, n = 30) or Supraclavicular plexus block (group S, n = 30).

INCLUSION CRITERIA

- Age 20- 35 yrs
- ASA risk status 1 & 2
- Cases posted for forearm surgeries
- Written informed consent

EXCLUSION CRITERIA

- Patient refusal
- ASA PS 3 & 4
- coexisting lung disease
- Heart,Liver, or Kidney disease
- Pregnancy
- Inability to understand the information provided
- Allergy to local anesthetics
- Chest deformities
- Previous clavicle fractures
- Neurological disorders
- Coagulopathies

MONITORING:

Intra operatively Non-invasive blood pressure, pulse oximetry and ECG were monitored.

PROCEDURE:

A 22-gauge 50-mm insulated stimulation short bevel needle (stimuplex connected to a nerve stimulator was used for both blocks. The initial stimulation current was set at 1.5mA with impulse duration of 0.1 ms. The needle position was considered to be adequate when the motor response in the hand or wrist is obtained

and remained visible with a maximum current of 0.5 mA. The local anesthetic, 20 ml 0.5% levobupivacaine and 10 ml of 2% lignocaine with adrenaline was injected slowly (60 s) with intermittent aspiration every 4-5ml. The supraclavicular block is performed with the patient in supine position and head turned to opposite side. The needle insertion site is 2.5cm lateral to insertion of sternocleidomastoid 1cm cephalad to clavicle.

The CORACOID infraclavicular approach will be performed on the supine position with the upper arm along the side, but with the elbow flexed and the hand resting on the lower chest or abdomen. After identifying the landmarks, the puncture site was 2cm below and 2 cm medial to coracoid process.

THE PARAMETERS MONITORED :

Primary Outcome :

1. Time of onset of sensory blockade
2. Time of onset of motor blockade
3. Quality of blockade

Secondary outcome :

1. Duration Of Analgesia
2. Complications
3. Hemodynamic variables

Time of Onset of sensory and motor blockade will be noted The sensory block evaluation for each nerve (radial, median, ulnar, musculocutanoeus, and medial cutaneous of forearm) will be assessed by testing for loss of cold sensation with a cotton soaked in spirit and will be graded 0, 1, 2. The motor block will be evaluated using the forearm flexion (musculocutaneous), thumb abduction(radial), thumb and second digit pinch (median), finger abduction (ulnar) nerves respectively and will be graded 0,1,2

GRADES	SENSORY	MOTOR
0	No loss	Able to resist
1	Less Cold	With Less force
2	Complete loss	Not able to move against gravity

The quality of the block was evaluated in the intra operative time:

a) **satisfactory block**- surgery without patient discomfort or the need for supplementation; or sensory and motor blockade of grade 2

b) **unsatisfactory block** - a sensory region involved in the surgery is not completely anesthetized and the block has to be supplemented by the continuous

infusion of propofol at 50 µg/kg/min and fentanyl 50microgram sensory or/and motor blockade of grade 1 or/and 2

c) **complete failure** - if the patient still experience pain despite supplementation, general anesthesia has to be induced by the attending anesthesiologist.

The side effects and complications, such as blood vessel puncture, intravascular injection, overdose, dyspnea, Horner's syndrome, and pneumothorax, were noted.

The duration of the sensory and motor block were also assessed post operatively and the duration of analgesia was also recorded.

DEFINITIONS:

Time of performance of blockade:

Duration of procedure commencing from needle puncture to withdrawal

Duration of the sensory block –

The time between the end of the local anesthetic injection and the total recovery of sensation.

Duration of the motor block-

The time between the end of the local anesthetic injection and the total recovery of motor functions.

Duration of analgesia

Time between the end of the local anesthetic injection and feeling of pain of score 4 or more or the need for rescue analgesic.

Rescue analgesic :

Injection tramadol100mg or Injection Diclofenac 50mg will be given as rescue analgesic

Satisfactory block- surgery without patient discomfort or the need for supplementation; or sensory and motor blockade of grade2

Unsatisfactory block - a sensory region involved in the surgery is not completely anesthetized and the block has to be supplemented by the continuous infusion of propofol at 50 µg/kg/min and fentanyl 50microgram sensory or/and motor blockade of grade 1 or/and 2

Complete failure - if the patient still experience pain despite supplementation, general anesthesia has to be induced by the attending anesthesiologist.

OBSERVATIONS AND RESULTS

In this study among the 60 patients, 30 patients received Supraclavicular block and 30 patients received Infraclavicular block. Hemodynamic variables like BP, pulse and heart rate,SPO2 ,Respiratory rate were monitored intra operatively and various parameters like onset of blockade ,quality of block, complications and duration of sensory and motor block and duration of analgesia were monitored postoperatively. These parameters were tabulated and analysed statistically using SSPS 17 software.

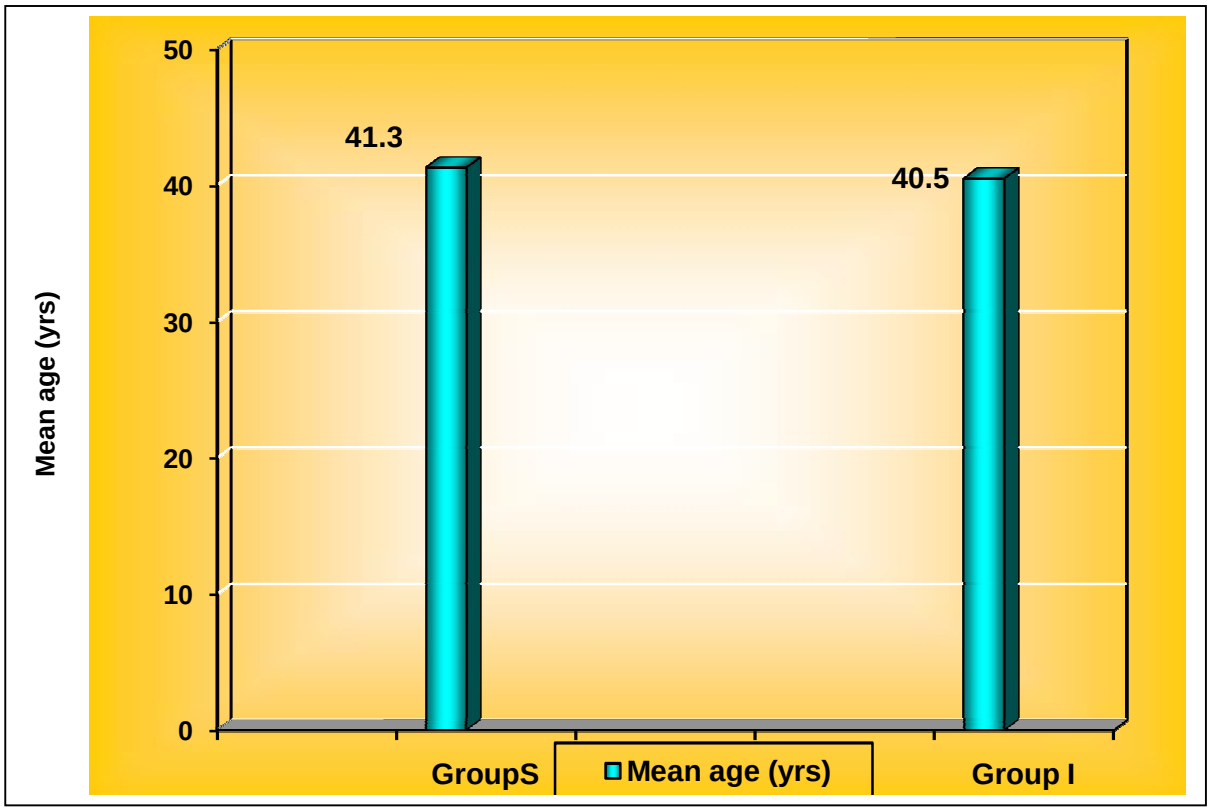
The demographic parameters like age, weight, height of all sixty patients are documented and tabulated and analysed statistically. All the demographic variables are comparable in both groups and are statistically insignificant

DISTRIBUTION OF AGE

Among the patients undergoing brachial plexus block for upper limb surgeries there was no statistically significant difference in relation to age distribution between group S (mean=41.3, SD=14.5) and group I (mean=40.5, SD=14.1) with a p value of >0.05 as per unpaired t test.

Age Group	No of Cases in			
	Group S		Group I	
	No	%	No	%
Upto 20 yrs	2	6.7	3	10.0
21 – 40 yrs	16	53.3	12	40.0
41 – 60 yrs	9	30.0	12	40.0
Above 60 yrs	3	10.0	3	10.0
Total	30	100.0	30	100.0
Range	17 - 75 yrs		18 - 72 yrs	
Medium	39 yrs		40 yrs	
Mean	41.3		40.5	
SD	14.5		14.1	
'p'	0.836 Not Significant			

DISTRIBUTION OF AGE



WEIGHT

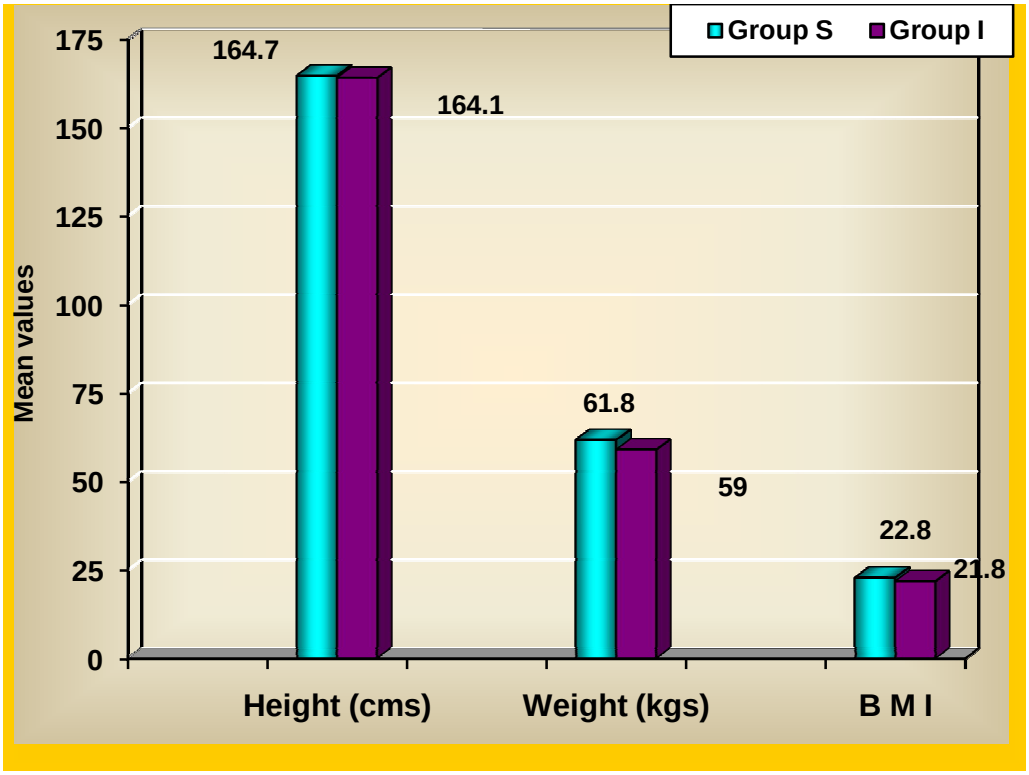
Group	Height (cms)		Weight (kgs)		BMI	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Group S	164.7	6.8	61.8	10.1	22.8	3.4
Group I	164.1	7.5	59.0	12.1	21.8	4.0
'p'	0.746 Not Significant		0.324 Not Significant		0.323 Not Significant	

There was no statistically significant difference in relation to height distribution between group S (mean=164.7, SD=6.8) and group I (mean=164.1, SD=7.8) with a p value of >0.05 as per unpaired t test.

There was no statistically significant difference in relation to height distribution between group S (mean=61.8, SD=10.1 and group I (mean=59.0, SD=12.1) with a p value of >0.05 as per unpaired t test.

There was no statistically significant difference in relation to BMI distribution between group S (mean=22.8, SD=3.4) and group I (mean=21.8, SD=4.0) with a p value of >0.05 as per unpaired t test.

DISTRIBUTION OF HEIGHT, WEIGHT AND BMI



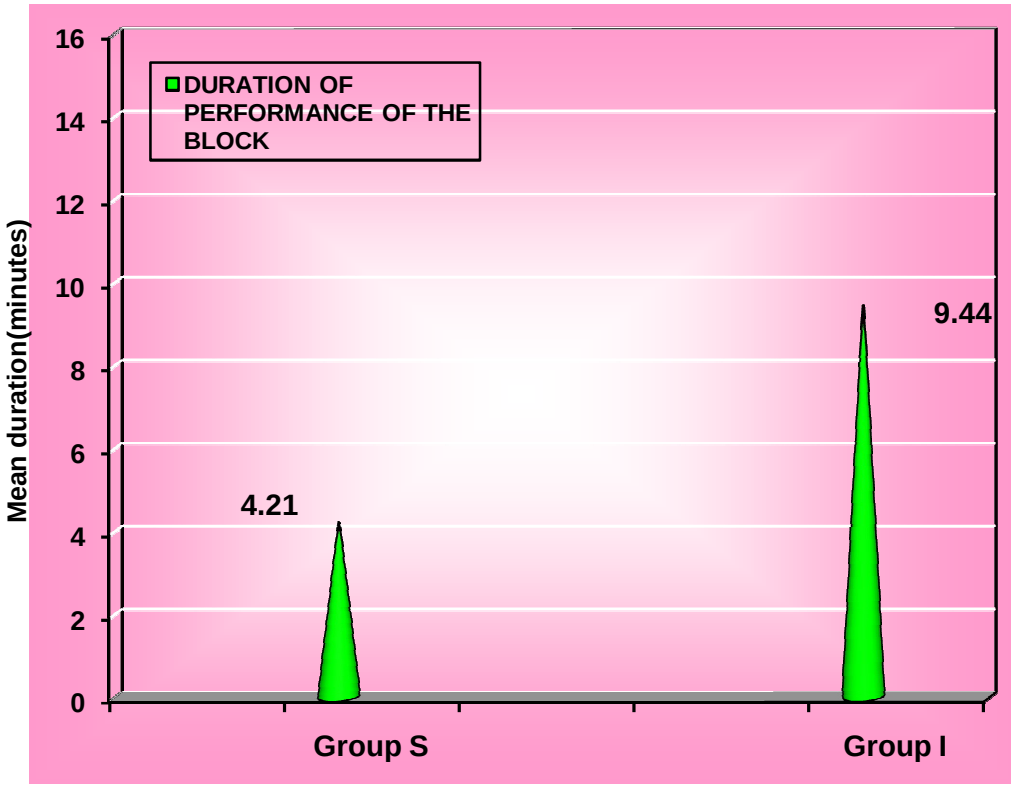
DURATION OF PERFORMANCE OF BLOCK

The duration of performance of blockade is defined as duration of procedure commencing from needle puncture to withdrawal

Group	**Duration of performance of block (minutes)**	
	Mean	**SD**
Group S	4.21	1.72
Group I	9.44	3.18
'p'	**0.043 Significant**	

The time taken to do Infraclavicular block was greater than time taken to perform Supraclavicular block. So There was a statistically significant difference in relation to duration of performance of block between group S (mean=4.21, SD=1.72) and group I (mean=9.44, SD=3.18) with a p value of <0.05 as per unpaired t test.

DURATION OF PERFORMANCE OF BLOCK



TYPE OF NERVE STIMULATED

Type of Nerve Stimulated	No of Cases in			
	Group S		Group I	
	No	%	No	%
Median nerve	17	56.7	15	50.0
Ulnar Nerve	2	6.6	4	13.3
Radial Nerve	11	36.6	11	36.7
Total	30	100.0	30	100.0

1. In group S

   Median nerve was stimulated in 56.7% patients.

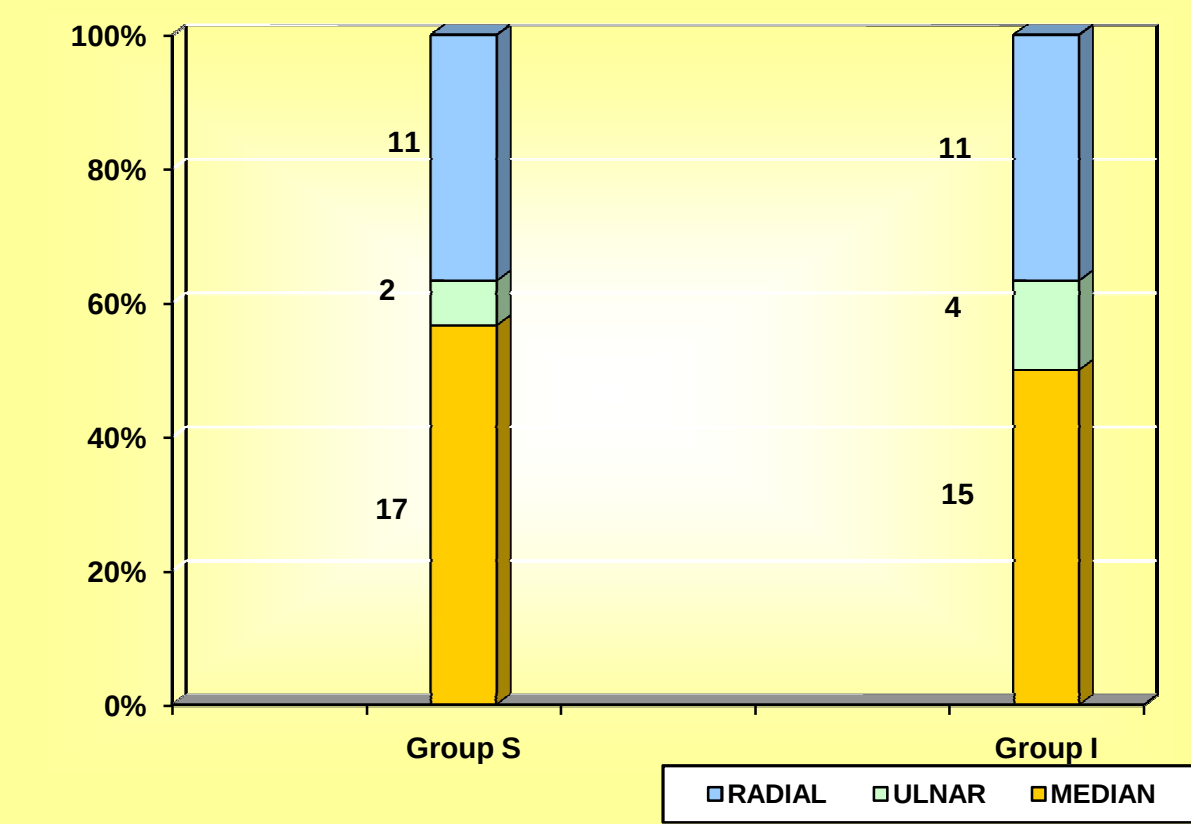
   Ulnar nerve was stimulated in 6.6 % patients.

   Radial nerve was stimulated in 36.6% patients.

2. In group I

   Median nerve was stimulated in 50.0% patients.

TYPE OF NERVE STIMULATED



Ulnar nerve was stimulated in 13.3% patients

Radial nerve was stimulated in 36.7% patients

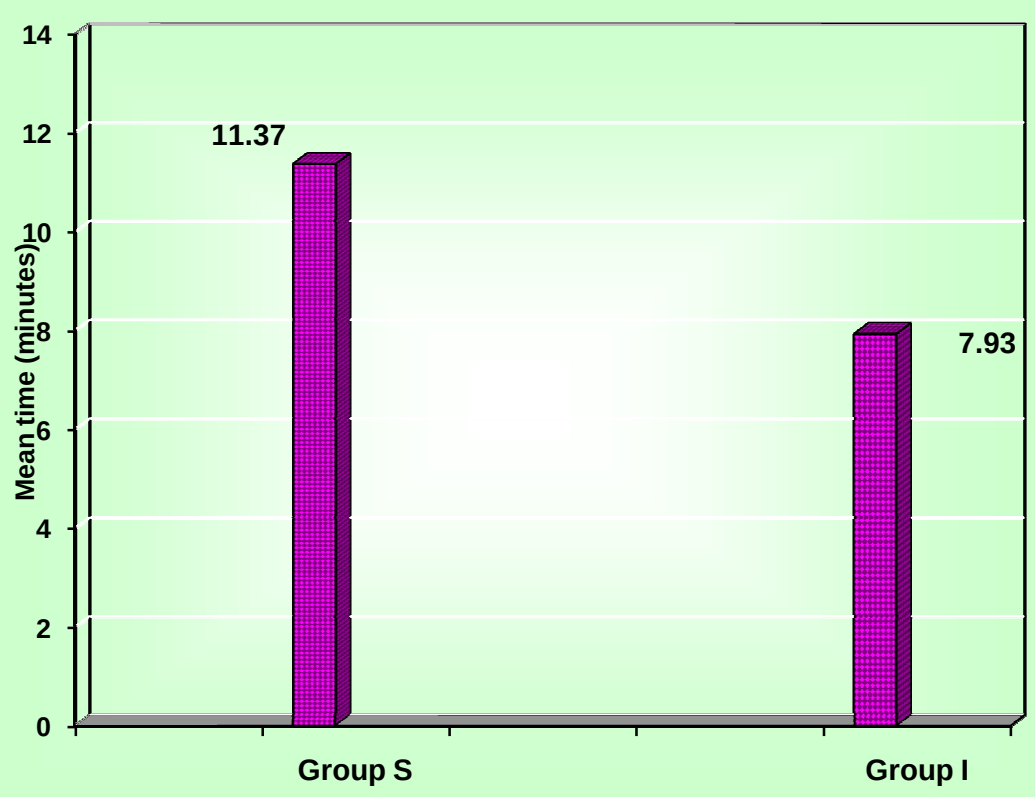
TIME OF ONSET OF SENSORY BLOCKADE

The time of onset of sensory blockade is assessed by checking cold sensation with spirit soaked cotton and graded accordingly.

Group	Onset of sensory blockade (minutes)	
	Mean	**SD**
Group S	11.37	5.81
Group I	7.93	6.48
'p'	**0.037 Significant**	

There was a statistically significant difference in relation to time of onset of block between group S (mean=11.37, SD=5.81) and group I(mean=7.93, SD=6.48) with a p value of <0.05 as per unpaired t test.

TIME OF ONSET OF SENSORY BLOCKADE



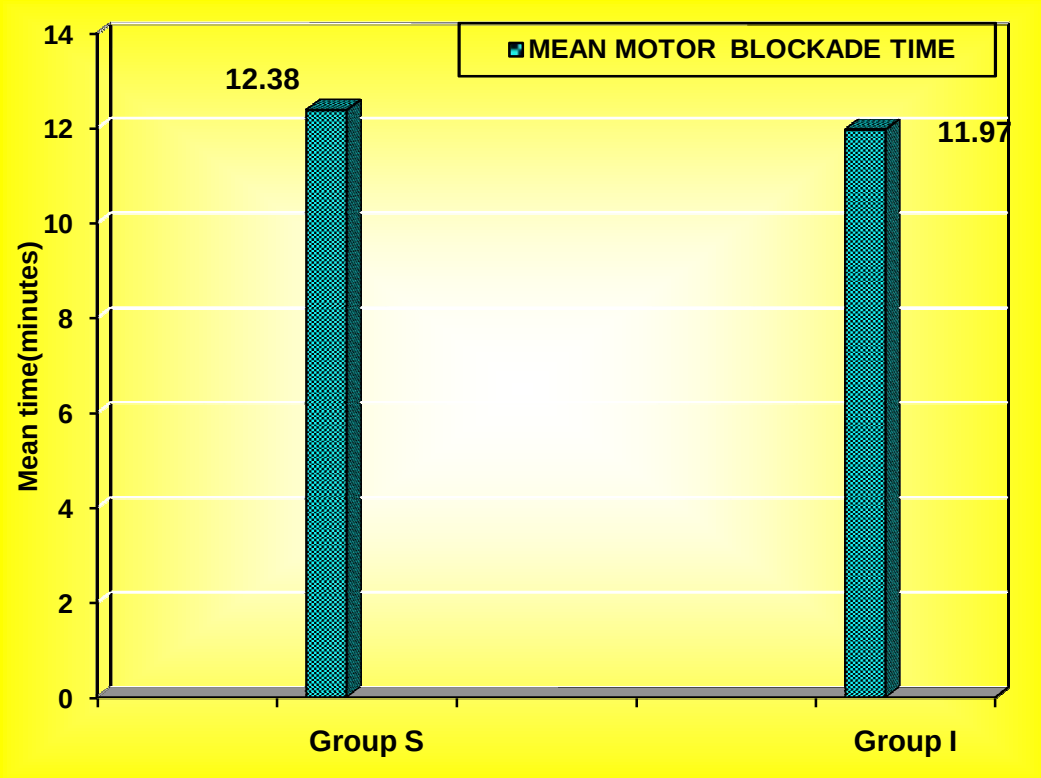
TIME OF ONSET OF MOTOR BLOCKADE

The time of onset of motor blockade is assessed by forearm flexion, thumb adduction , thumb adduction ,thumb & second digit pinch and finger abduction and graded 0,1,2

Group	**Motor Blockade Time (minutes)**	
	Mean	SD
Group S	12.38	5.95
Group I	11.97	11.08
'p'	0.86 Not Significant	

The motor blockade time was almost equal in both groups .There was no statistically significant difference in relation to time of onset of motor blockade between group S (mean=12.38, SD=5.95) and group I (mean=11.97, SD=11.08) with a p value of 0.86 [>0.05 as per unpaired t test] .

TIME OF ONSET OF MOTOR BLOCKADE



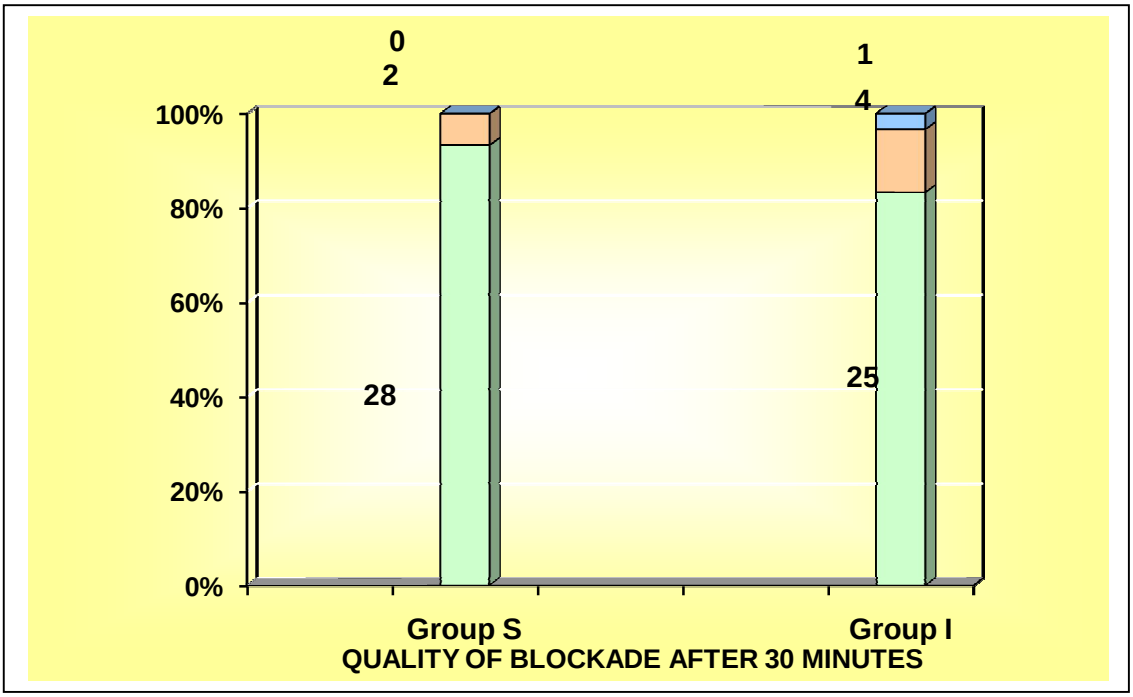
QUALITY OF BLOCKADE

Quality of Blockade after 30 minutes	No of Cases in			
	Group S		Group I	
	No	%	No	%
Satisfactory	28	93.3	25	83.3
Unsatisfactory	2	6.7	4	13.3
Complete failure	-	-	1	3.3
'p'	0.132 Not significant			

There was no statistically significant difference in relation to quality of block between group S and group I with 93% satisfactory block in group S compared to 83.3% in group I with a p value of <0.05 as per unpaired t test.

The unsatisfactory blockade was higher in infraclavicular block[13.3%] compared to supraclavicular block [6.7%] but not statistically significant. The only one case of complete failure was seen in infraclavicular study.

QUALITY OF BLOCKADE

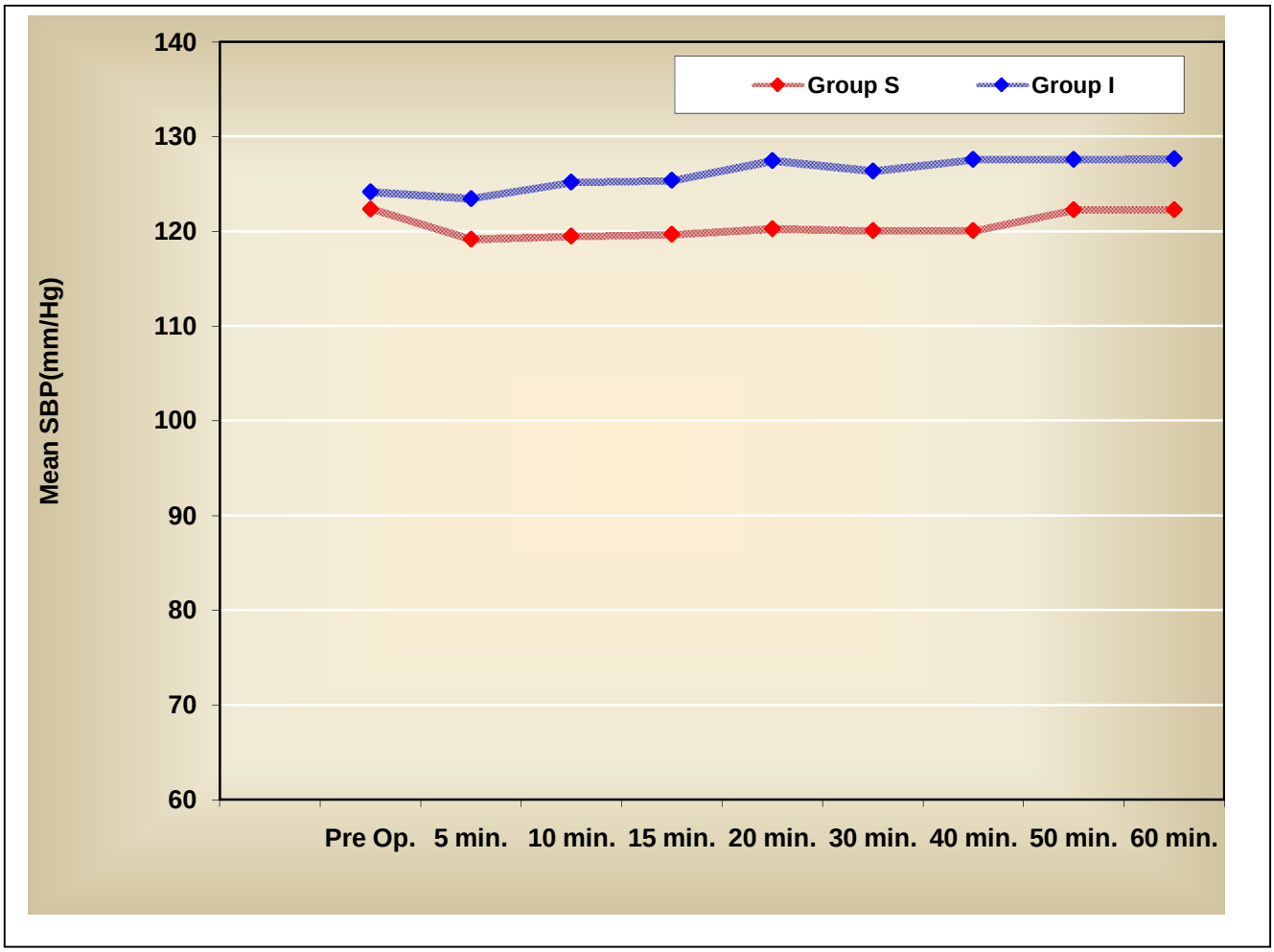


SYSTOLIC BLOOD PRESSURE

SBP at	SBP (mm/Hg) of				'p'	Significance
	Group S		Group I			
	Mean	SD	Mean	SD		
Pre Operative	122.4	13.0	124.2	12.9	0.607	Not Significant
5 minutes	119.2	9.7	123.5	13.7	0.171	Not Significant
10 minutes	119.5	9.5	125.2	12.5	0.053	Not Significant
15 minutes	119.7	10.7	125.4	14.4	0.087	Not Significant
20 minutes	120.3	11.3	127.5	16.7	0.057	Not Significant
30 minutes	120.1	11.0	126.4	16.0	0.081	Not Significant
40 minutes	120.1	11.0	127.6	17.7	0.054	Not Significant
50 minutes	122.3	9.3	127.6	17.7	0.151	Not Significant
60 minutes	122.3	9.3	127.7	17.6	0.141	Not Significant

There was no statistically significant difference in relation to systolic blood pressure between group S and group I

SYSTOLIC BLOOD PRESSURE

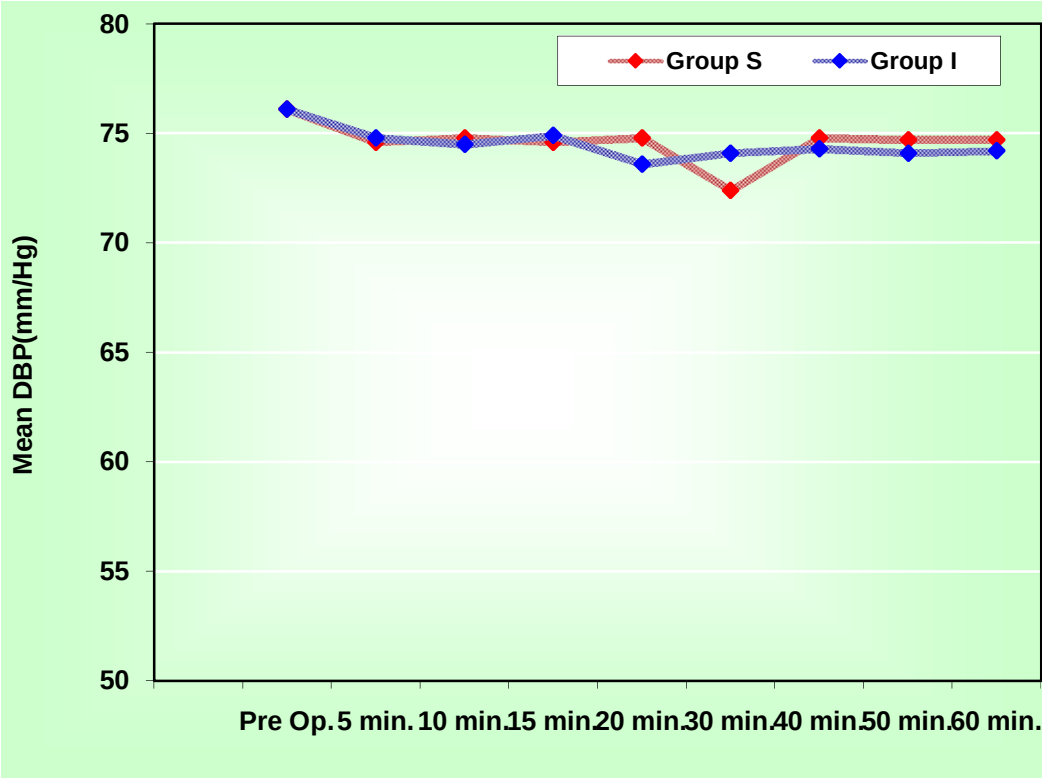


DIASTOLIC BLOOD PRESSURE

DBP at	DBP (mm/hg) of				'p'	Significant
	Group S		Group I			
	Mean	SD	Mean	SD		
Pre op.	76.1	6.9	76.1	6.1	1.0	Not Significant
5 minutes	74.6	5.5	74.8	11.8	0.933	Not Significant
10 minutes	74.8	5.4	74.5	11.6	0.921	Not Significant
15 minutes	74.6	5.5	74.9	11.9	0.912	Not Significant
20 minutes	74.8	5.7	73.6	11.5	0.812	Not Significant
30 minutes	72.4	13.3	74.1	12.0	0.606	Not Significant
40 minutes	74.8	5.4	74.3	11.9	0.857	Not Significant
50 minutes	74.7	5.4	74.1	11.7	0.789	Not Significant
60 minutes	74.7	5.4	74.2	11.7	0.811	Not Significant

There was no statistically significant difference in relation to diastolic blood pressure between group S and group I

DIASTOLIC BLOOD PRESSURE

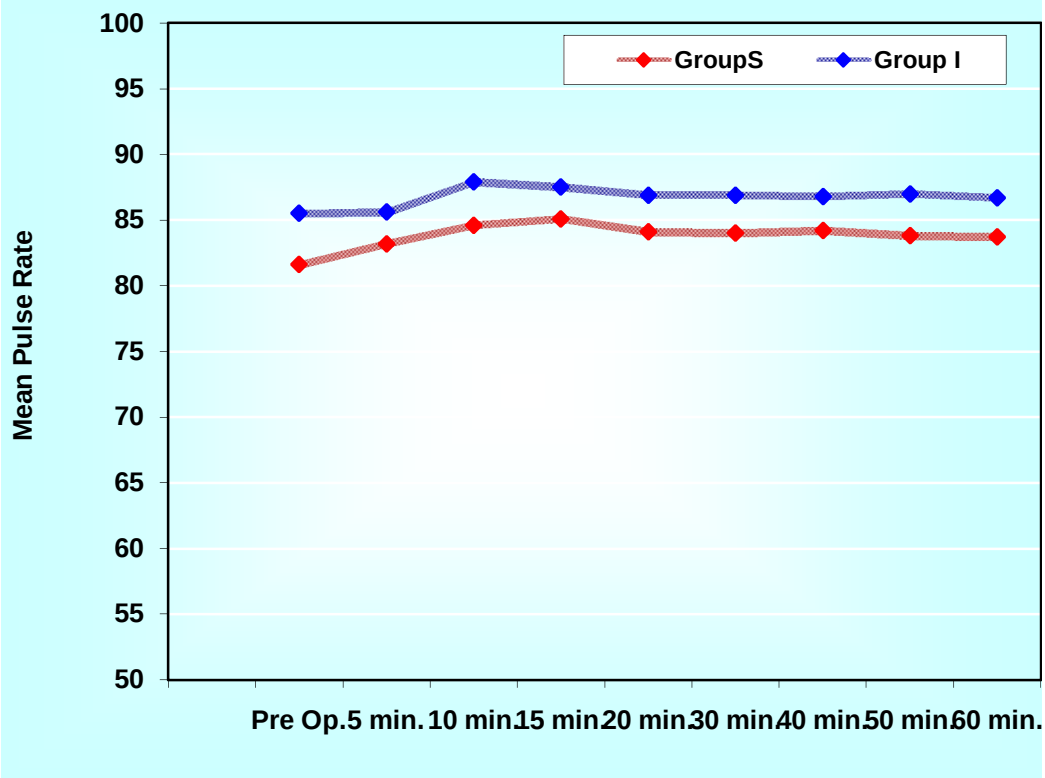


PULSE RATE

Pulse rate at	Pulse Rate of				'p'	Significant
	Group S		Group I			
	Mean	SD	Mean	SD		
Pre durative	81.6	15.1	85.5	8.2	0.224	Not Significant
5 minutes	83.2	10.6	85.6	5.7	0.287	Not Significant
10 minutes	84.6	10.3	87.9	10.0	0.213	Not Significant
15 minutes	85.1	10.2	87.5	9.8	0.362	Not Significant
20 minutes	84.1	8.9	86.9	9.9	0.252	Not Significant
30 minutes	84.0	8.3	86.9	10.0	0.221	Not Significant
40 minutes	84.2	8.0	86.8	10.1	0.275	Not Significant
50 minutes	83.8	8.3	87.0	10.2	0.196	Not Significant
60 minutes	83.7	8.2	86.7	10.2	0.214	Not Significant

There was no statistically significant difference in relation to pulse rate between group S and group I

PULSE RATE


100
95
90
85
80
75
70
65
60
55
50
Mean Pulse Rate
GroupS
Group I
Pre Op.
5 min.
10 min
15 min
20 min.
30 min
40 min
50 min
60 min.

SPO_2 AND RESPIRATORY RATE

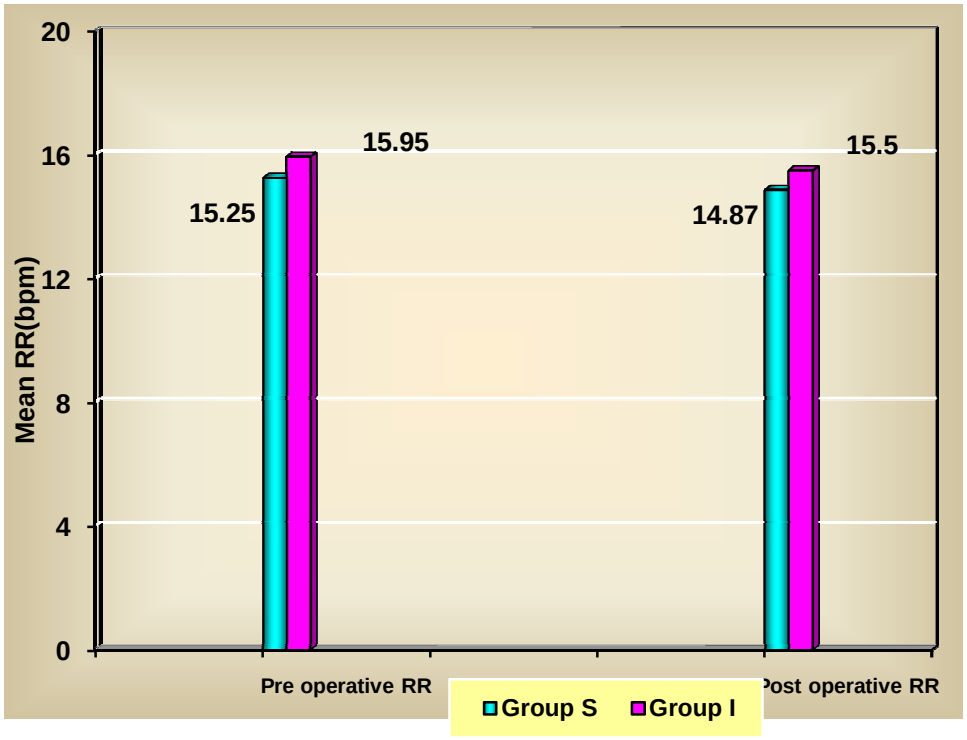
SPO2 and respiratory rate were monitored every 5 minutes for half an hour thereafter every 10 minutes and the results were tabulated

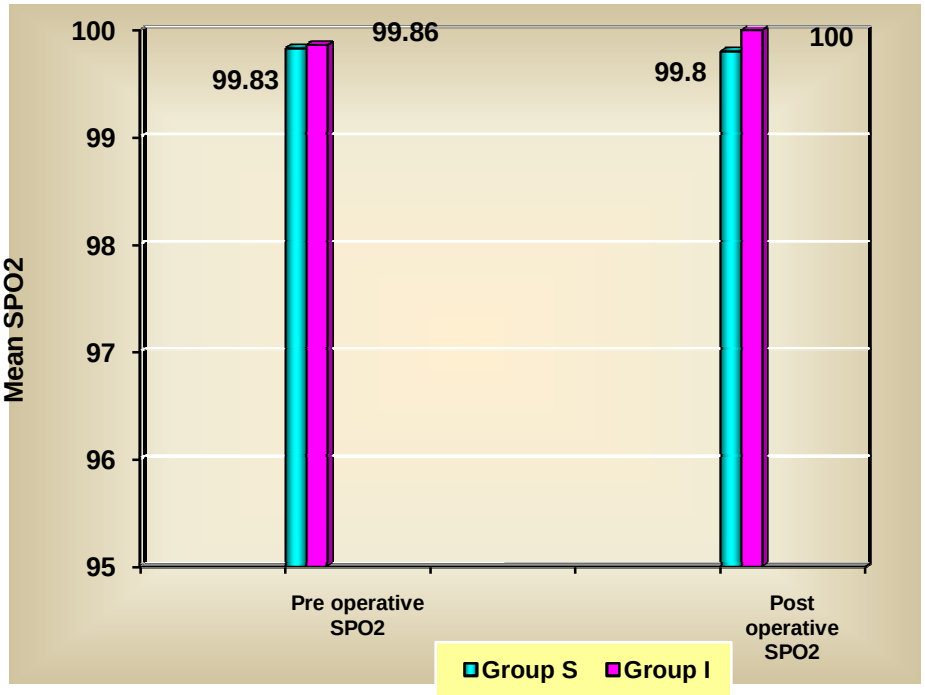
Group	SPO2				Respiratory Rate			
	Pre op.		Post of		Pre op.		Post of.	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Group S	99.83	0.91	99.8	0.551	15.25	1.67	14.87	2.11
Group I	99.86	0.44	100.0	0	15.95	2.1	15.5	1.82
'p'	0.879 Not Significant		0.051 Not Significant		0.193 Not Significant		0.218 Not Significant	

There was no statistically significant difference in relation to respiratory rate between group S and group I.

There was no statistically significant difference in relation to peripheral capillary oxygen saturation between group S and group I.

SPO_2 AND RESPIRATORY RATE

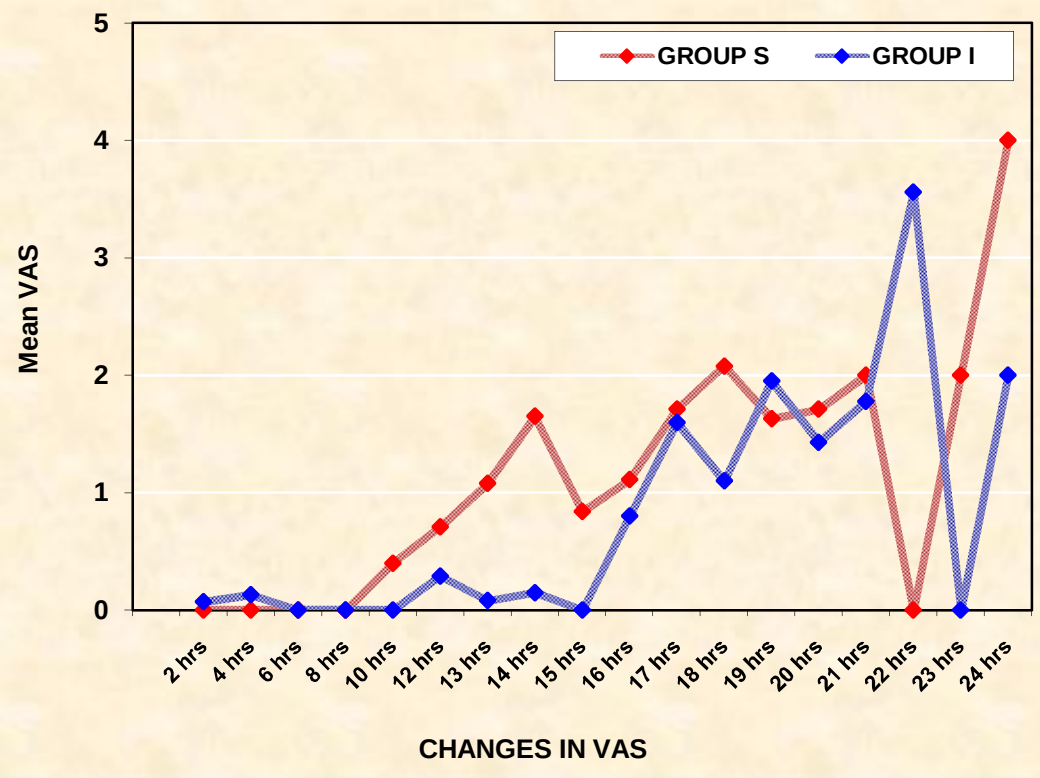




VISUAL ANALOG SCORE

VAS at hours	VAS in				'p'	Significance
	Group S		Group I			
	Mean	SD	Mean	SD		
2	0	-	0.07	0.37	0.321	Not Significant
4	0	-	0.133	0.73	0.322	Not Significant
6	0	-	0	-	-	Not Significant
8	0	-	0	-	-	Not Significant
10	0.4	1.1	0	-	0.056	Not Significant
12	0.71	1.24	0.29	1.05	0.169	Not Significant
13	1.08	1.02	0.08	0.39	**<0.001**	**Significant**
14	1.65	1.72	0.15	0.78	**<0.001**	**Significant**
15	0.84	1.21	0	-	**0.001**	**Significant**
16	1.11	1.71	0.8	1.0	0.457	Not Significant
17	1.71	1.49	1.6	1.53	0.822	Not Significant
18	2.08	1.73	1.1	1.02	0.051	Not Significant
19	1.63	1.77	1.95	1.85	0.674	Not Significant
20	1.71	2.4	1.43	1.99	0.765	Not Significant
21	2.0	2.31	1.78	0.67	0.787	Not Significant
22	0	-	1.78	0.68	0.786	Not Significant
23	2.0	-	-	-	-	-
24	4	-	2	-	-	-

VAS SCORE


GROUP S
GROUP I
Mean VAS
5
4
3
2
1
0
2 hrs
4 hrs
6 hrs
8 hrs
10 hrs
12 hrs
13 hrs
14 hrs
15 hrs
16 hrs
17 hrs
18 hrs
19 hrs
20 hrs
21 hrs
22 hrs
23 hrs
24 hrs
CHANGES IN VAS

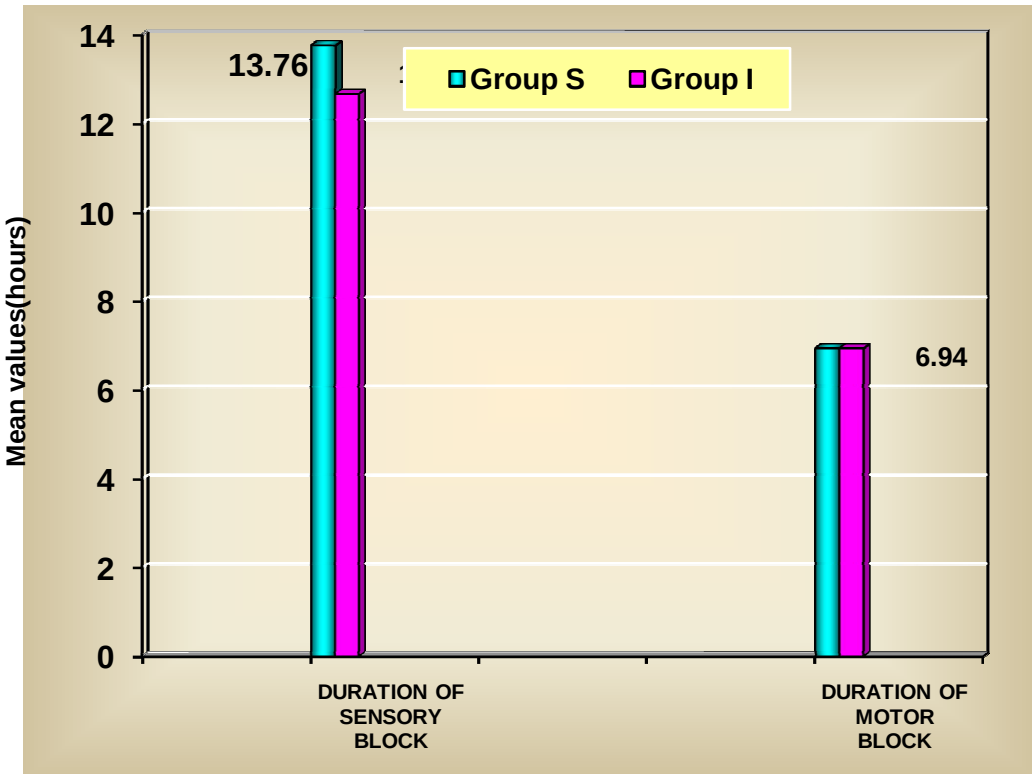
There was a statistically significant difference in relation to VAS scores between group S and group I after 13hours post operatively with patients of group S had higher scores compared to group I with a p value of <0.05 as per unpaired t test.

DURATION OF SENSORY AND MOTOR BLOCKADE

Group	Total duration of			
	Sensory block (hours)		**Motor Block (hours)**	
	Mean	**SD**	**Mean**	**SD**
Group S	13.76	2.8	6.72	1.28
Group I	12.67	5.8	6.94	3.02
'p'	0.751Not significant		0.722 Not Significant	

There was a no statistically significant difference in relation to duration of analgesia between groupS and group I with a p value of <0.05 as per unpaired t test.

DURATION OF SENSORY AND MOTOR BLOCKADE



COMPLICATIONS

No patients in both groups reported any complications like

- Blood vessel puncture,
- Intravascular injection,
- Dyspnea
- Horner’s syndrome,
- Pneumothorax, will be noted

DISCUSSION

"Brachial plexus blockade avoids general anaesthesia which has its set of complications like delayed recovery, poly pharmacy, loss of consciousness of the patient etc., To increase the success rate and to avoid complications, various techniques have been developed. In this study the supraclavicular and infraclavicular blocks were performed under nerve stimulator guidance. Paresthesia techniques are associated with nerve injuries and high failure rates. To avoid failure and nerve injuries, nerve locator is used.

In supraclavicular block, blockade occurs at the distal trunk – proximal division level"[34]. At this location the brachial plexus is compact and even small volume of local anaesthetic injection produces rapid onset of reliable blockade of the brachial plexus.

In infraclavicular block, the blockade occurs at the level of cords and offers advantages of avoiding complications like pneumothorax and this approach also offers blockade of musculo-cutaneous and axillary nerves. There is nil chance of pnemothorax in this technique. It offers early and complete blockade and avoids complications of supraclavicular blockade.

In this study supraclavicular block was performed using Winnie and Collins perivascular approach and infraclavicular block was performed using coracoid technique under nerve stimulator guidance.

Levobupivacaine when compared to bupivacaine has greater vasoconstrictive action and longer sensory block and less motor block. The real advantage is that it is less cardiotoxic. Hence in this study levobupivacaine, lignocaine with adrenaline mixture was used ***adjuvants*** to local anaesthetics in brachial plexus block to quicken the onset, increase the duration and the quality of block and also to reduce the post operative requirement of analgesics.

All demographic variables between two intervention groups were comparable. According to ***chun woo yang et al*** [7] in 2010 ,there is no significant difference in sensory and motor block evolution, quality of blockade and no difference in duration of sensory and motor blocks.

But in my study ,the time of onset of sensory blockade was earlier in group I [7.93± 6.48] compared to group S [11.37±5.81] and it is statistically significant [p value of 0.037].. So, the time to readiness for surgery was achieved earlier in group I compared to group S.

The duration of block performance was longer in group I [9.44± 3.18] compared to group S [4.21± 1.72] and it was statistically significant [p value of 0.043]. So the block performance time was longer in infraclavicular group compared to supraclavicular group.

The quality of blockade was satisfactory in 93.3%patients and 83.3%in group S and group I respectively it was not statistically significant. The

unsatisfactory block was higher in infraclavicular blockade [13.3%] compared to supraclavicular block [6.7%]

The time of onset of motor blockade was similar in both the groups. The duration of sensory and motor blockade were comparable between the intervention groups.

Chun woo yang et al [7]had reported complications like Horners syndrome and pneumothorax in their study whereas in this study nil complications were noted. This could be possibly explained by the vertical infraclavicular approach and plumb bob technique they had used.

In this study ,the time taken to do Infraclavicular block (mean=9.44, SD=3.18) was greater than time taken to perform Supraclavicular block (mean=4.21, SD=1.72). It was statistically significant with a p value of <0.05 as per unpaired t test.

In another study conducted by ***Alan macfarlene et al*** [1]vertical infraclavicular block scored high success rate but they have reported serious complications like phrenic nerve palsy and pneumothorax. But here in my study supraclavicular block [93.3%] has high success rate compared to infracavicular block [83.3%] but it is not statistically significant.And they required multiple pericoracoid injections. In this study no such complications were noted.

In the study conducted by ***Yavuz gurkan et al*** [48]the reported mean duration of analgesia was 13±8 hours and a mean duration of motor block of 6±2 hours using 20 ml of 0.5% levobupivacaine and 10 ml of 2% lignocaine in infraclavicular blocks. In this study the duration of sensory blockade is 13.76±2.8 hours in group S and 12.67±5.8 hours in group I. The duration of motor blockade is 6.72±1.28 hours in group S and 6.94±3.02 hours in group I. The duration of sensory and motor blockade are comparable in both groups and is not statistically significant.This is comparable to the above said study.

In the research study conducted by ***Thirivikrama padur tantry*** [41]to prevent exclusion of ulnar nerve, finger flexion, wrist flexion, wrist adduction may be used for lower trunk blockade because sparing of ulnar nerve often leads to failure of blockade. In this study motor response in fingers were taken as endpoint of neuro stimulation to avoid failure of blockade

So in my study comparing both Infraclavicular and Supraclavicular block, we found that Infraclavicular block using coracoid approach for forearm surgeries under Nerve Stimulator guidance is better than supraclavicular blockade because sensory blockade is achieved earlier which shows that patient is ready earlier for surgery with good quality of blockade and comparable duration of sensory and motor blockade without any complications. However the time taken for performing the infraclavicular block is longer than supraclavicular block which is statistically

significant. We had no complications and patients were hemodynamically stable throughout the perioperative period

SUMMARY

All demographic variables between two intervention groups were comparable.

The duration of block performance was longer in group I [9.44± 3.18] compared to group S [4.21± 1.72] and it was statistically significant [p value of 0.043].

The time of onset of sensory blockade was earlier in group I [7.93± 6.48] compared to group S [11.37±5.81] and it is statistically significant [p value of 0.037]. Hence time of readiness for surgery was lesser in group I .But Performance of infraclavicular block consumes longer time than supraclavicular block.

The time of onset of motor blockade was similar in both the groups and not statistically significant.

The duration of sensory and motor blockade were comparable between the intervention groups and not statistically significant. All the patients showed no changes in hemodynamic parameters.

None of the patients reported any complications.

CONCLUSION

Infraclavicular block using coracoid approach is a better alternative to supraclavicular block for forearm surgeries under nerve stimulator guidance as sensory blockade is achieved earlier with good quality of blockade and duration of sensory and motor blockade without any complications.

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ANNEXURES

Ref.No.3971/ME2/2016

Office of the Dean
Kanyakumari Govt. Medical College
Asaripallam 629 201

Dated: .11.2016

CERTIFICATE OF ETHICAL COMMITTEE APPROVAL

The Institutional Ethical Committee meeting was conducted on 10.11.2016 at 11.00 am at Medical Education Unit, Kanyakumari Govt. Medical College Asaripallam, to give approval of your study title "A Prospective double blinded randomized study to compare supraclavicular Vs infraclavicular blocks for forearm surgeries under nerve stimulator guidance".

The following members of the Ethical Committee attended the Meeting.

1. Chairman : Dr. M. Kannan. M.D.,
Prof of Anaesthesia (Retired)

2. Basic Medical Scientists : 1.Dr. R. Rajesh M.D.,
Assoc. Professor & HOD of Forensic Medicine
Kanyakumari Govt. Medical College Asaripallam

2. Dr. K.U. Suresh Balan MD
Associ. Prof & HOD of Community Medicine
Kanyakumari Govt. Medical College Asaripallam

3. Clinicians : 1. Dr. Usha M.S
Prof. & HOD of Surgery
Kanyakumari Govt. Medical College Asaripallam

2. Dr. Prince Sree Kumar Pius MD
Prof. of Medicine
Kanyakumari Govt. Medical College Asaripallam

3. Dr. J. Chitra M.D
Prof. & HOD of Obstetrics & Gynaecology
Kanyakumari Govt. Medical College Asaripallam

4. Dr. A.J.S Pravin M.D
Prof. & HOD of Dermatology
Kanyakumari Govt. Medical College Asaripallam

5. Dr. J.A. Jayalal M.S
Assoc. Prof. of Surgery,
Kanyakumari Govt. Medical College Asaripallam

6. Dr. Edward Johnson MD
Assoc. Prof. of Anaesthesia,
Kanyakumari Govt. Medical College Asaripallam

4.	Representative of Non Government Voluntary Agency	:	Mrs. Jesintha Dharma
5.	Theologian	:	Dr. Surendra M.A, M.Phil, M.Ed.,Ph.D.,
6.	Statistician	:	Dr. J. Merlin Premala Ph.D
7.	Lay Person	:	Thiru. Justin OP Block (May I Help You) KGMCH Asaripallam
8.	Member Secretary	:	Dr. T. Ashok Kumar M.D., Prof & HOD of Pharmacology Kanyakumari Govt. Medical College Asaripallam

The committee has given approval of your study subject to the following conditions

- The Study should be conducted in its presented form.
- The Progress of the study and any changes in the study to be informed to the committee
- Copy of the final result of study may be furnished to the committee.

Member Secretary
Institutional Ethical Committee
Kanyakumari Govt Medical College
Asaripallam

MEMBER SECRETARY
INSTITUTIONAL ETHICAL COMMITTEE
KANYAKUMARI GOVT. MEDICAL COLLEGE
ASARIPALLAM - 629 201

Chairman
Institutional Ethical Committee
Kanyakumari Govt Medical College
Asaripallam

CHAIRMAN
INSTITUTIONAL ETHICAL COMMITTEE
KANYAKUMARI GOVT. MEDICAL COLLEGE
ASARIPALLAM

To

Dr. J. Rosebell
PG in MD Anaesthesia
Dept. of Anaestheisa
KGMC Asaripallam

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INTRODUCTION “Peripheral nerve blocks can be customized and used for anaesthesia, post operative analgesia and diagnosis and treatment of chronic pain disorders”.40 Nerves or plexus supplying a particular region is blocked using local anesthetic and is made insensitive to pain and reflex responses to surgical stimuli. It is superior to general anesthesia in many aspects like sparing CNS, keeping the patient alert, awake and cooperative and avoiding polypharmacy. It can be used both for elective as well as emergency surgeries.

INTRODUCTION “Peripheral nerve blocks can be customized and used for anaesthesia, post operative analgesia and diagnosis and treatment of chronic pain disorders”.40 Nerves or plexus supplying a particular region is blocked using local anesthetic and is made insensitive to pain and reflex responses to surgical stimuli. It is superior to general anesthesia in many aspects like sparing CNS, keeping the patient alert, awake and cooperative and avoiding polypharmacy. It can be used both for elective as well as emergency surgeries.

The Viennese ophthalmologist

Dr. Karl Koller introduced cocaine as the first local anaesthetic in 1884. He used cocaine solution for topical corneal anaesthesia in patients undergoing ophthalmic surgeries. The initial local anesthetic agents developed during the first half of 20th century were amino ester compounds. The main disadvantages were shorter duration of action, allergy and systemic toxicity. Then the amino amide compounds were discovered. Levo-Bupivacaine is an amide type of long acting local anaesthetic agent which facilitates its usage to carry out prolonged surgeries in extremities. Additives

A PROSPECTIVE DOUBLE BLINDED RANDOMIZED STUDY TO COMPARE SUPRACLAVICULAR Vs INFRACLAVICULAR BLOCKS FOR FOREARM SURGERIES UNDER NERVE STIMULATOR GUIDANCE

PROFORMA

PATIENT DETAILS DATE:

NAME	AGE/SEX	IP. NO.	WARD

HEIGHT	WEIGHT	BMI

DIAGNOSIS	SURGERY	ASA RISK STATUS

STUDY GROUP

SUPRA-CLAVICULAR BLOCK(S)		INFRA –CLAVICULAR BLOCK(I)	

PRE –ANAESTHETIC EXAMINATION: GENERAL CONDITION:

CVS: RS:

VITALS :

PULSE RATE	BP	SPO2	RR

TIME OF PERFORMANCE OF BLOCK:

START TIME		END TIME	

TYPE OF NERVE STIMULATED:

MEDIAN NERVE		ULNAR NERVE		RADIAL NERVE	

TIME OF ONSET OF BLOCKADE:

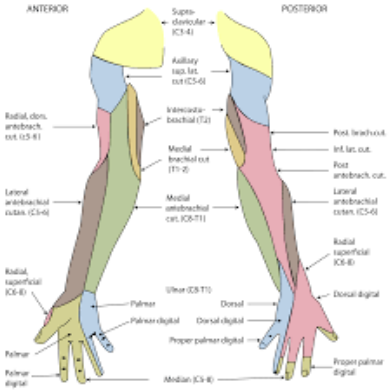
SENSORY		MOTOR	

TIME OF SURGERY:

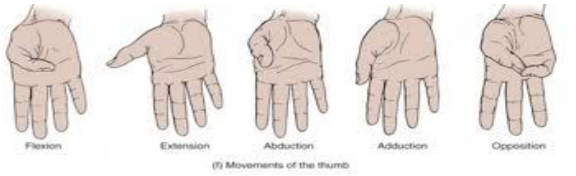
START		END		DURATION	

SENSORY BLOCK EVALUATION: (LOSS OF COLD SENSATION) 0-NO LOSS 1-LESS COLD 2-COMPLETE LOSS

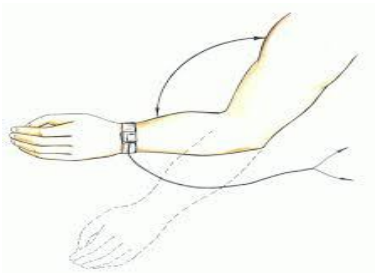
TIME	RADIAL NERVE	MEDIAN NERVE	ULNAR NERVE	MUS-CUT NERVE
5MIN				
10MIN				
15MIN				
20MIN				
25MIN				
30MIN				



MOTOR BLOCKADE:



) 0-NOT ABLE TO MOVE 1-ABLE TO RESIST WITH LESS FORCE 2-FULL POWER



QUALITY OF BLOCKADE AFTER 30 MIN

TIME	RADIAL NERVE (dorsiflexion of wrist)	MEDIAN NERVE (finger opposition)	ULNAR NERVE (Finger abduction)	MUS-CUT NERVE (Forearm flexion)
5MIN				
10MIN				
15MIN				
20MIN				
25MIN				
30MIN				

SATISFACTORY BLOCK SURGERY WITHOUT DISCOMFORT		UNSATISFACTORY BLOCK NEEDS SUPPLEMENTATION	
COMPLETE FAILURE CONVERTED TO GA			

NO. OF ATTEMPTS:

POST OP SENSORY BLOCKADE(HRS)

2	4	6	8	10	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26

POST OP MOTOR BLOCKADE(HRS)

2	4	6	8	10	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26

TOTAL DURATION OF SENSORY AND MOTOR BLOCK:

SENSORY BLOCK		MOTOR BLOCK	

TIME OF PERCEPTION OF PAIN:

DURATION OF ANALGESIA(VAS SCORE)

2	4	6	8	10	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26

HEMODYNAMIC MONITORING(BP/PR/SPO2)

PARAMETERS	5MIN	10MIN	15MIN	20MIN	30MIN	40MIN	50MIN	60MIN
NIBP								
PR								
SPO2								
RR								

COMPLICATIONS:

GROUP - S																			
S No	Name	Age	Sex	Height	Weight Kg	BMI	Diagnosis	Surgery	Pulse	BP	SPO2	RR	Time of performance of block		Actual Time	Type of nerve stimulated	Time of OnSet of Blockade		
													Start Time AM	End Time AM		Median Nerve	Ulnar Nerve	Radial Nerve	Sensory - AM
1	Thanga Pushpam	28	F		80		# Distal Radius	ORIF with plating	90	140/80	100	14	9.15	9.27	0.12			Ö	9.28
2	Jeya Chandran	70	M				# Distal Radius	ORIF with plating	98	110/70	100	18	9.06	9.15	0.09	Ö			9.16
3	Muthu	36	M				# Distal Radius	ORIF with plating	80	140/80	100	14	9.15	9.27	0.12	Ö			9.28
4	Sahaya Micheal Abishek	17	M		50		# Distal Radius	ORIF with plating	82	110/70	100	14	9.31	9.39	0.08	Ö			9.42
5	Jackulin Mary	44	F		52		# Distal Radius	ORIF with plating	106	130/80	100	18	12.15	12.25	0.1	Ö			12.27
6	Mohammed Rafik	55	M		60		# Distal Radius	ORIF with plating	106	130/87	100	18	12.15	12.25	0.1			Ö	12.27

7	Subbiah	40	M		58		Olecranon - R	ORIF with plating	80	110/70	100	15	10.15	10.25	0.1	Ö			10.25
8	Vel Murugan	35	M		60		Fracture L Ulna	ORIF with plating	86	130/80	100	16	9.45	9.5	0.05	Ö			9.49
9	Justin	37	M		58		Fracture L Ulna	ORIF with plating	86	110/70	100	17	9.2	9.23	0.03			Ö	9.26
10	Viji	39	F	155	80		B Furem	ORIF with plating	86	130/80	100	16	9.45	9.5	0.05	Ö			9.49
11	Shaju	27	M		63		# Scaphoid	ORIF with plating	60	140/80	100	14	9.15	9.27	0.12			Ö	9.28
12	Chinna Nadar	75	M	155	50		#BB (R) Fore arm	ORIF with plating	72	110/70	100	14	10.3	10.36	0.06	Ö	Ö		10.33
13	Saju Ramkumar	28	M	160	60		Extensor Tendon Injury	Reconstruction	84	130/84	100		9.4	9.52	9.5	Ö			9.5
14	Christopher	43	M				thumb Tenden Reconstruction		90	110/70	100	14	10.05	10.15	0.1	Ö			10.08
15	Pramesh	39	M				Fracture L Ulna	ORIF with plating	78	120/70	100		11.1	11.23	0.13	Ö			11.25

16	Sundaresan	39	M		80		Ulna (L) Orif		60	140/80	100	14	9.15	9.27	0.12			Ö	9.28
17	Libin	28	M	170	65		Ulna (L) forearm	ORIf	86	110/80	100	14	11.4	11.5	0.1			Ö	11.48
18	Dharmalingam	53	M		50		Fracture L Ulna	ORIF with plating	64	110/70	100	14	9.13	9.39	0.26			Ö	9.42
19	Kamaraj	18	M		50		# Distal Radius	ORIF with plating	64	110/70	100	14	9.31	9.39	0.08	Ö			9.42
20	Sivagamy	34	F		52		# Distal Radius	ORIF with plating	106	130/80	100	18	12.15	12.25	0.1	Ö			12.27
21	Kanthan	45	M		60		# Distal Radius	ORIF with plating	106	130/87	100	18	12.15	12.25	0.1			Ö	12.27
22	Kumarasamy	30	M		58		Olecranon - R	ORIF with plating	80	110/70	100	15	10.15	10.25	0.1	Ö			10.25
23	Manikandan	49	M		80		Ulna (L) Orif		60	140/80	100	14	9.15	9.27	0.12			Ö	9.28
24	Thangamuthu	32	M	170	65		Ulna (L) forearm	ORIf	86	110/80	100	14	11.4	11.5	0.1			Ö	11.48
25	Nallaperumal	44	M		50		Fracture L Ulna	ORIF with plating	64	110/70	100	14	9.13	9.39	0.26			Ö	9.42

26	Muthulekshmi	38	F		80		# Distal Radius	ORIF with plating	60	140/80	100	14	9.15	9.27	0.12			Ö	9.28
27	Iyyappan	71	M				# Distal Radius	ORIF with plating	98	110/70	100	18	9.06	9.15	0.09	Ö			9.16
28	Maniarasu	32	M				# Distal Radius	ORIF with plating	60	140/80	100	14	9.15	9.27	0.12	Ö			9.28
29	Chidambaram	52	M		65		TBWrist	Open Biopsy Sypovial excusion	80	110/70	100	16	9	9.1	0.1	Ö			9.13
30	Ranjitham	60	F				# BB forearm	ORIF with plating	91		95	14	11.4	11.5	0.1			Ö	11.48
31	Devarajan	50	M		60		# Ulna	ORIF with plating	92	140/80	100		10.37	10.44	0.07	Ö			10.44
32	Chellammal	65	F		39		Distal Radius # (R)		98	110/70	100	18	9.06	9.15	0.09	Ö		Ö	9.16
33	Johnson	72	M	158	68		Galezzi # forearem	Orif L	92	130/80	100	14	10.4		-10.4			Ö	10.45
34	Mariya Lenin	50	M		70		# distal radius		109	140/90	98	20	9.25	9.33	0.08	Ö			9.35

35	Maria Kurusu	50	M		49		# distal radius	Orif	80	110/70	100	14	10.15	10.25	0.1			Ö	10.25
36	Sabari Kirshna	44	M		62		# Middle 1/3rd J Ulna & base of 1st Metacorpal	Orif Plating + K wire	82	100/70	100	14	9.05	9.2	0.15	Ö			9.07
37	Nabisha Lulu	18	F	155	68		# Bbfore arm	Plating	80	120/80	100	16	11.3	11.36	0.06	Ö			11.35
38	Vignesh	24	M	158	49		# Bbfore arm	Plating	92	130/80	100		10.4		-10.4			Ö	10.45
39	Muthu Kutty	20	M	165	90		# Middle 1/3rd J Ulna & base of 1st Metacorpal	Orif Plating + K wire	92	140/80	100		10.37	10.44	0.07			Ö	10.44
40	Ramasamy	29	M		35		Fore arm BB#	Orif Plating	98	110/70	100	18	9.06	9.15	0.09	Ö		Ö	9.16
41	Mohan Rajesh	18	M		54		Multiple Me# comm distal radius #	Orif Plating	80	127/88	100	18	9.32	9.36	0.04	Ö			9.36
42	Muthusamy	27	M		52		# Bbfore arm	Plating	89	130/80	100	16	10.35	10.47	0.12		Ö		sparing

43	Sundaresan	39	M		61		# Distal Radius (R)	Orif	78	78	100	14	9.3	9.4	0.1			Ö	3
44	Selva Kamaraj	37	M		57		Extensor Tendon Injury	Reconstruction	80	80	100		9.53	9.56	0.03	Ö			3
45	Muthu	56	M		76		# Middle 1/3rd J Ulna & base of 1st Metacorpal	Orif Plating + K wire	80	110/70			10.1		-10.1		Ö		2
46	Thangam	65	F		59		# Bbforearm	Plating	86	110/70	1400		11.4	11.5	0.1			Ö	11.48
47	Selva Nayagam	34	M		67		# Middle 1/3rd J Ulna & base of 1st Metacorpal	Orif Plating + K wire	66		100	17	9.2	9.25	0.05			Ö	9.26
48	Alphonse	50	M		58		# Middle 1/3rd J Ulna & base of 1st Metacorpal	Orif Plating + K wire	86	130/80	100	16	9.45	9.5	0.05	Ö			9.49
49	Muthunayagam	47	M		69		# distal radius	Orif	92	140/80	100		10.37	10.44	0.07	Ö	0		10.44

50	Robinson	46	M	164	60		BB fore arm	Orif	86	130/80	100	18	9.1	9.25	0.15	Ö			9.27
51	Ramasamy	29	M	158	40		# Middle 1/3rd J Ulna & base of 1st Metacorpal	Orif Plating + K wire	80	127/80	99	18	9	9.06	0.06			Ö	9.1
52	Mutharasu	48	M		49		# distal radius	Orif	80	110/70	100	14	10.15	10.25	0.1			Ö	10.25
53	Tamilarasan	34	M		62		# Middle 1/3rd J Ulna & base of 1st Metacorpal	Orif Plating + K wire	82	100/70	100	14	9.05	9.2	0.15	Ö			9.07
54	Jeevananthan	42	M		69		# distal radius	Orif	92	140/80	100		10.37	10.44	0.07	Ö	0		10.44
55	Mahalingam	41	M	164	60		BB fore arm	Orif	86	130/80	100	18	9.1	9.25	0.15	Ö			9.27
56	Kumar	28	M	158	40		# Middle 1/3rd J Ulna & base of 1st Metacorpal	Orif Plating + K wire	80	127/80	99	18	9	9.06	0.06			Ö	9.1

57	Chelladurai	37	M		52		# Bbfore arm	Platin g	89	130/ 80	100	16	10.35	10.4 7	0.1 2		Ö		spar ing
58	Nallakannu	36	M		61		# Distal Radius (R)	Orif	78	78	100	14	9.3	9.4	0.1			Ö	3
59	Naveen	26	M		57		Extens or Tendon Injury	Recon structi on	80	80	100	12	9.53	9.56	0.0 3	Ö			3
60	Iyyampure mal	53	M		76		# Middle 1/3rd J Ulna & base of 1st Metaco rpal	Orif Platin g + K wire	80	110/ 70	100	14	10.1	10.4	0.3		Ö		10.4 4

				Sensory block evaluation																				
	Time of Surgery			5 Min				10 Min				15 Min				20 Min	25 Min				30 Min			
Motor - AM	Start Time - AM	End Time - AM	Total duration	Radial Nerve	Median Nerve	Ulnar Nerve	Mus-Cut Nerve	Radial Nerve	Median Nerve	Ulnar Nerve	Mus-Cut Nerve	Radial Nerve	Median Nerve	Ulnar Nerve	Mus-Cut Nerve	Radial Nerve	Median Nerve	Ulnar Nerve	Mus-Cut Nerve	Radial Nerve	Median Nerve	Ulnar Nerve	Mus-Cut Nerve	Radial Nerve
9.28	9.59	11.45	1.86	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.17	9.4	11	1.6	1	1	4	4	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.3	9.59	11.45	1.86	1	4	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.43	9.5	11.2	1.7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12.28	12.4	1.3	-11.1	1	4	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12.28	12.4	1.3	-11.1	1	4	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.25	10.37	11.57	1.2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.5	10.05	12	1.95	1	0	0	1	2	0	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2
9.23	9.4	10.4	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.5	10.05	12	1.95	1	0	0	1	2	0	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2
9.3	9.59	11.45	1.86	1	0	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.36	10	12.15	2.15	2	2	2	2	2	2	2	0	2	2	2	0	2	2	2	0	2	2	2	0	2
9.51	10	12.15	2.15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.1	10.2	10.5	0.3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	1	2
11.25	11.3	12.45	1.15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.3	9.59	11.45	1.86	1	0	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11.5	12	2.15	-9.85	2	0	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.43	9.5	11.2	1.7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.43	9.5	11.2	1.7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12.28	12.4	1.3	-11.1	1	4	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12.28	12.4	1.3	-11.1	1	4	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.25	10.37	11.57	1.2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.3	9.59	11.45	1.86	1	0	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11.5	12	2.2	-9.8	2	0	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.43	9.5	11.2	1.7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	9.59	11.45	1.86	1	4	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.17	9.4	11	1.6	1	1	4	4	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2

9.3	9.59	11.45	1.86	1	4	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.13	9.25	11.58	2.33	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11.5	12	2.1	-9.9	1	1	1	2	1	1	1	2	1	1	1	2	2	1	2	2	2	2	2	2	2
10.44	10.55	12.05	1.5	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.17	9.4	11	1.6	1	1	0	0	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.43	10.5	12.2	1.7	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.36	9.4	11.1	1.7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.25	10.35	12.5	2.15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.2	9.45	10.5	1.05	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11.36	11.45	1.3	-10.15	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.46	10.5	12.04	1.54	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.44	10.55	12.05	1.5	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.17	9.4	11	1.6	1	1	0	0	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.36	9.45	11	1.55	0	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	10.39	11.4	1.01	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	10	12.05	2.05	0	0	2	2	0	1	2	2	0	2	2	0	0	2	2	2	0	2	2	2	0
	10.05	12.15	2.1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.44	10.55	12.05	1.5	2	2	0	2	2	2	0	2	2	2	0	2	2	2	0	2	2	2	0	2	2
11.5	12	2.06	-9.94	2	0	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.23	9.4	11.58	2.18	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.5	10.05	12	1.95	1	0	0	1	2	0	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2
10.44	10.55	12.05	1.5	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.27	9.4	11.3	1.9	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.4	9.3	12	2.7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.25	10.35	12.46	2.11	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.2	9.45	10.5	1.05	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.44	10.55	12.05	1.5	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.27	9.4	11.3	1.9	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9.4	9.3	12	2.7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	10.39	11.4	1.01	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	10	12.1	2.1	0	0	2	2	0	1	2	2	0	2	2	0	0	2	2	2	0	2	2	2	0
	10.05	12.36	2.31	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10.44	10.55	12.05	1.5	2	2	0	2	2	2	0	2	2	2	0	2	2	2	0	2	2	2	0	2	2

	Motor Block Evaluation

			5 Min				10 Min				15 Min				20 Min				25 Min				30 Min	
Median Nerve	Ulnar Nerve	Mus-Cut Nerve	Radial Nerve	Median Nerve	Ulnar Nerve	Mus-Cut Nerve	Radial Nerve	Median Nerve	Ulnar Nerve	Mus-Cut Nerve	Radial Nerve	Median Nerve	Ulnar Nerve	Mus-Cut Nerve	Radial Nerve	Median Nerve	Ulnar Nerve	Mus-Cut Nerve	Radial Nerve	Median Nerve	Ulnar Nerve	Mus-Cut Nerve	Radial Nerve	Median Nerve
0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	2	2	2	1	1	2	2	0	1	2	1	0	0	0	0	0	0	0	0	0	0
2	2	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	0	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	1	0	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	1	0	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	2	2	2	1	1	2	2	0	1	2	1	0	0	0	0	0	0	0	0	0	0
2	2	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

2	2	2	1	0	0	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	0	0	0	0	1	1	0	0	2	1	0	1	2	2	2	2	2	2	2	2	2	2
2	2	2	1	0	0	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	1	0	0	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	1	0	0	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	0	0	0	0	1	1	0	0	2	1	0	1	2	2	2	2	2	2	2	2	2	2
2	2	2	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0
2	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	2	0	2	2	2	0	2	2	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	1	0	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	1	0	0	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	1	0	0	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	2	0	2	2	2	0	2	2	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0

	Quality of blockae after 30 Min	No. of Attempts	POST OP SENSORY BLOCKADE (HRS)	POST OP MOTOR BLOCKADE (HRS)

Ulnar Nerve	Mus-Cut Nerve	Satisfactory Block	Un Satisfactory Block	Complete Failure		2	4	6	8	10	12	13	14	15	16	17	18	19	20	21	22	23	24	2
0	0	Ö			2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	2
0	0	Ö			2	2	2	2	2	2	2	2	2	2	2	2	2	1	0	0	0	0	0	0
0	0	Ö			2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0
2	2	Ö			2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	Ö			1	2	2	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0	0
0	0	Ö			2	2	2	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0	2
0	0	Ö			1	2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0
0	0	Ö			2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	Ö			1	2	2	2	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	2
2	2	Ö			2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	Ö				2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	1	2
2	2	Ö			1	2	2	2	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	2
0	0	Ö			2	2	2	2	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	2
0	0	Ö			1	2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0	Ö			1	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	Ö			2	2	2	2	2	2	2	1	2	0	0	0	0	0	0	0	0	0	0	0
2	2	Ö			2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	2
0	0	Ö			2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	Ö			2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	Ö			1	2	2	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0	0
0	0	Ö			2	2	2	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0	2
0	0	Ö			1	2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0
0	0	Ö			2	2	2	2	2	2	2	1	2	0	0	0	0	0	0	0	0	0	0	0
2	2	Ö			2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	2
0	0	Ö			2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	Ö			2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	Ö			2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	2
0	0	Ö			2	2	2	2	2	2	2	2	2	2	2	2	2	1	0	0	0	0	0	0
0	0	Ö			2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	Ö	0		2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2				2	2	2	2	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	2
2	2	Ö			1	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2	2	Ö			2	2	2	2	2	2	2	2	2	2	2	2	2	1	0	0	0	0	0	2
2	2	Ö			1	2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0	Ö			3	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0

0	0	Ö	0		2	2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	2
2	2	Ö			3	2	2	2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	2
2	2		Ö		2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2	2	Ö			1	2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
2	2	Ö			1	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2	2	Ö			2	2	2	2	2	2	2	2	2	2	2	2	2	1	0	0	0	0	0	2
0	1	Ö			2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0				1	2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0		Ö		2	1	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	Ö			2	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
0	0		Ö		1	2	2	2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0
2	2	Ö			2	2	2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	2
0	0	Ö			1	2	2	2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0
0	0	Ö			2	2	2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0
2	2	Ö			1	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0				2	2	2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0
0	0				1	2	2	2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0
0	0	Ö	0		2	2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	2
2	2	Ö			3	2	2	2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	2
2	2	Ö			1	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0				2	2	2	2	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0
0	0				1	2	2	2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0
0	0				1	2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0		Ö		2	1	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	Ö			2	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
0	0		Ö		1	2	2	2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0

																		TOTAL DURATION OF SENSORY AND MOTOR BLOCKS		Time of Perception of Pain	DURATION OF ANALGESIA (VAS SCORE)			
4	6	7	8	10	12	13	14	15	16	17	18	19	20	21	22	23	24	SENSORY BLOCK	MOTOR BLOCK		2	4	6	8
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	7	10.15 am	0	0	0	0
0	0	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	18	9		0	0	0	0
1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	7		0	0	0	0
0	0		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	11	10	10:00 PM	0	0	0	0

0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	18	5.3	6.00 AM	0	0	0	0
2	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	5.3	6.00 AM	0	0	0	0
0	0		1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	15	6.3		0	0	0	0
0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	12.3	6	5.30 AM	0	0	0	0
2	2		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	7		0	0	0	0
0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	13	7.3	6.30 AM	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	7	0	0	0	0	0
2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	7		0	0	0	0
2	2		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.6	6		0	0	0	0
2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	6.3		0	0	0	0
0	0	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	13	6		0	0	0	0
1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	7		0	0	0	0
2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	17	6	6.00 AM	0	0	0	0
0	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	11	6	10.00PM	0	0	0	0
0	0		1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	11	10	10:00 PM	0	0	0	0
0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	18	5.3	6.00 AM	0	0	0	0
2	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	5.3	6.00 AM	0	0	0	0
0	0		1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	15	6.3	5.00 AM	0	0	0	0
1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	7		0	0	0	0
2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	17	6	6.00 AM	0	0	0	0
0	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	11	6	10.00PM	0	0	0	0
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	7		0	0	0	0
0	0	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	18	9		0	0	0	0
1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	7		0	0	0	0
0	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	9	6	6.00 AM	0	0	0	0
2	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	11	5.3		0	0	0	0
2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	7		0	0	0	0
2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	18	9		0	0	0	0
2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	6		0	0	0	0
0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	13	9	8.30 PM	0	0	0	0
2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13.3	8.3	4.30 AM	0	0	0	0
2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	6	0	0	0	0	0
2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	5		2	4*		
2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	6		0	0	0	0
2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	7		0	0	0	0
2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	18	9		0	0	0	0
0	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	12.3	8	13 hrs	0	0	0	0
2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0	0	0	0

2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			8.00 pm	0	0	0	0
0	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2					0	0	0	0
0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	12	3			0	0	0	0
2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	16		6.00 AM	0	0	0	0
0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	9	1			0	0	0	0
2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.3		6.00 AM	0	0	0	0
2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	7			0	0	0	0
2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0	0	0	0
0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2					0	0	0	0
2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13.3	8.3		4.30 AM	0	0	0	0
2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	6		0	0	0	0	0
2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	7			0	0	0	0
2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0	0	0	0
0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2					0	0	0	0
2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					0	0	0	0
2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			8.00 pm	0	0	0	0
0	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2					0	0	0	0
0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	12	3			0	0	0	0

														HEMODYNAMIC MONITORING										
														NIBP								PULSE RATE		
10	12	13	14	15	16	17	18	19	20	21	22	23	24	5 MIN	10 MIN	15 MIN	20 MIN	30 MIN	40 MIN	50 MIN	60 MIN	5 MIN	10 MIN	15 MIN
0	0	2	4 *											110/70	110/70	110/70	110/70	110/70	110/70	120/700	120/700	89	82	86
0	0	0	0	0	0	0	0	0	0	0	0	2	4 *	110/70	110/70	110/70	110/70	110/70	110/70	110/70	110/70	80	80	80
0	0	2	4 *											110/70	110/70	110/70	110/70	110/70	110/70	120/70	120/70	88	82	72
4 *														110/70	110/70	110/70	110/70	110/70	110/70	110/70	110/70	84	84	84
0	2	2	2	2	4 *									130/80	130/80	130/80	130/80	130/80	130/80	130/80	130/80	104	106	107
0	2	2	2	2	2	3	4 *							130/80	130/80	140/80	140/80	140/80	140/80	140/80	140/80	104	106	103

0	0	0	0	0	0	2	4*							120/80	120/80	120/80	120/80	120/80	120/80	120/80	120/80	84	84	84
0	0	0	0	0	0	2	3	4*						130/80	130/80	130/80	136/82	134/80	134/80	130/80	130/80	86	86	86
0	0	0	0	0	0	2	2	3	4*					130/80	130/80	130/80	130/80	130/80	130/80	130/80	130/80	86	88	88
0	0	0	0	0	0	0	2	3	4*					130/80	130/80	130/80	136/82	134/80	134/80	130/80	130/80	86	86	86
0	0	2	4*											110/70	110/70	110/70	110/70	110/70	110/70	120/70	120/70	69	92	82
0	0	0	0	0	0	0	0	0	0	4*				140/90	140/90	140/90	140/90	140/90	140/90	140/90	140/90	88	86	88
0	0	0	0	0	0	2	2	3	4*					130/80	130/80	130/80	130/80	130/80	130/80	130/80	130/80	84	84	82
0	2	2	2	2	4*									125/70	122/75	120/70	120/70	122/75	122/75	122/75	122/75	81	81	81
0	0	0	0	0	0	0	0	0	0	4*				120/70	120/70	120/70	120/70	120/70	120/70	120/70	120/70	78	88	87
0	0	2	4*											110/70	110/70	110/70	110/70	110/70	110/70	120/70	120/70	69	72	72
0	0	0	0	0	0	4*								110/70	110/70	110/70	110/70	110/70	110/70	110/70	110/70	84	84	84
2	4*													120/75	120/75	120/75	120/75	120/75	120/75	120/75	120/75	82	82	82
4*														110/70	110/70	110/70	110/70	110/70	110/70	110/70	110/70	64	64	64
0	2	2	2	2	4*									130/80	130/80	130/80	130/80	130/80	130/80	130/80	130/80	104	106	107
0	2	2	2	2	2	3	4*							130/80	130/80	140/80	140/80	140/80	140/80	140/80	140/80	104	106	107
0	0	0	0	0	0	2	4*							120/80	120/80	120/80	120/80	120/80	120/80	120/80	120/80	84	84	84
0	0	2	4*											110/70	110/70	110/70	110/70	110/70	110/70	120/70	120/70	69	72	96
0	0	0	0	0	0	4*								110/70	110/70	110/70	110/70	110/70	110/70	110/70	110/70	84	84	84
2	4*													120/75	120/75	120/75	120/75	120/75	120/75	120/75	120/75	82	82	82
0	0	2	4*											110/70	110/70	110/70	110/70	110/70	110/70	120/700	120/700	69	72	76
0	0	0	0	0	0	0	0	0	0	0	0	2	4*	110/70	110/70	110/70	110/70	110/70	110/70	110/70	110/70	80	80	80
0	0	2	4*											110/70	110/70	110/70	110/70	110/70	110/70	120/70	120/70	69	72	76
0	2	2	2	2	4*									110/70	120/70	110/70	112/70	112/70	112/70	112/70	112/70	82	82	82

0	0	2	3	4*										132/78	132/78	132/78	136/80	132/8	132/78	134/76	134/76	80	80	82
0	0	0	0	0	0	0	0	0	0	2	4*			144/82	140/80	141/81	142/80	135/85	135/85	135/85	135/85	92	97	97
0	0	0	0	0	2	2	2	4*						110/20	110/20	110/20	110/20	110/20	110/20	110/20	110/20	80	80	80
0	0	0	0	0	0	0	0	0	0	2	4*			130/80	130/80	130/80	130/80	130/80	130/80	130/80	130/80	92	92	92
0	0	2	4*											110/90	142/90	140/90	130/90	130/90	132/86	132/80	132/80	92	90	91
0	0	0	0	0	2	2	2	4*						120/80	120/80	120/80	120/80	120/80	120/80	120/80	120/80	80	80	80
0	0	0	0	0	2	4*								100/70	100/70	100/70	100/70	100/70	100/70	100/70	100/70	82	82	82
														121/80	136/82	130/80	128/72	126/70	120/80	122/78	126/80	98	112	102
0	0	0	0	0	0	0	0	0	0	2	4*			110/80	110/80	110/80	110/80	110/80	110/80	110/80	110/80	92	92	92
0	0	0	0	0	0	0	0	0	0	2	4*			144/82	140/80	141/81	142/80	135/85	135/85	135/85	135/85	92	97	97
0	0	0	0	0	0	0	0	0	0	0	0	0	2*	110/70	110/70	110/70	110/70	110/70	110/70	110/70	110/70	80	80	80
0	4*													122/82	120/80	117/88	117/80	117/80	117/80	117/80	117/80	82	84	82
0	0	0	0	0	0	2	2	3	4*					132/72	132/72	132/72	132/72	132/72	132/72	132/72	132/72	81	81	81
0	0	0	0	0	2	2	2	4*						140/70	142/70	146/70	162/80	162/80	162/80	162/80	162/80	94	112	114
0	4*													130/80	132/80	136/80	142/70	142/70	152/70	152/70	152/70	84	83	82
0	0	0	0	0	0	0	0	0	0	2	4*			110/70	120/70	110/70	112/70	112/70	112/70	112/70	112/70	82	82	82
0	0	0	0	0	2	4*								110/70	110/70	110/70	110/70	110/70	110/70	110/70	110/70	84	84	84
0	0	0	0	0	0	2	2	3	4*					132/80	132/80	132/80	132/80	132/80	132/80	132/80	132/80	76	78	78
0	0	0	0	0	0	0	2	4*						130/80	130/80	130/80	136/82	134/80	134/80	130/80	130/80	86	86	86
0	0	0	0	0	0	0	0	0	0	2	4*			144/82	140/80	141/81	142/80	135/85	135/85	135/85	135/85	92	97	97
0	0	0	0	0	2	4*								110/70	120/70	110/70	112/70	112/70	112/70	112/70	112/70	82	82	82
0	0	0	0	0	0	2	2	3	4*					130/80	132/80	136/80	142/70	142/70	152/70	152/70	152/70	84	83	82
0	0	0	0	0	2	2	2	4*						120/80	120/80	120/80	120/80	120/80	120/80	120/80	120/80	80	80	80
0	0	0	0	0	2	4*								100/70	100/70	100/70	100/70	100/70	100/70	100/70	100/70	82	82	82
0	0	0	0	0	0	0	0	0	0	2	4*			144/82	140/80	141/81	142/80	135/85	135/85	135/85	135/85	92	97	97
0	0	0	0	0	2	4*								110/70	120/70	110/70	112/70	112/70	112/70	112/70	112/70	82	82	82
0	0	0	0	0	0	2	2	3	4*					130/80	132/80	136/80	142/70	142/70	152/70	152/70	152/70	84	83	82
0	0	0	0	0	0	2	2	3	4*					132/72	132/72	132/72	132/72	132/72	132/72	132/72	132/72	81	81	81
0	0	0	0	0	2	2	2	4*						140/70	142/70	146/70	162/80	162/80	162/80	162/80	162/80	94	112	114
0	4*													130/80	132/80	136/80	142/70	142/70	152/70	152/70	152/70	84	83	82
0	0	0	0	0	0	0	0	0	0	2	4*			110/70	120/70	110/70	112/70	112/70	112/70	112/70	112/70	82	82	82

					SPO2	RR
20 MIN	30 MIN	40 MIN	50 MIN	60 MIN		
82	82	81	81	81	100	14
80	80	80	80	80	100	14

82	82	82	82	82	100	15
84	84	83	83	82	100	14
103	102	102	102	102	98	20
103	100	100	100	100	99	20
84	84	84	84	84	100	14
84	84	84	82	80	100	13
86	84	83	82	82	100	14
84	84	84	82	80	100	14
82	82	81	81	81	100	14
92	90	90	90	90	100	14
82	84	82	82	80	100	14
81	81	81	81	81	100	13
87	86	88	88	87	100	14
72	72	82	81	81	100	14
84	84	84	84	84	100	14
82	82	82	82	82	100	14
74	74	74	73	73	100	14
103	102	102	102	102	98	20
103	100	100	100	100	99	20
84	84	84	84	84	100	14
72	72	72	71	72	100	14
84	84	84	84	84	100	14
82	82	82	82	82	100	14
72	72	72	71	72	100	14
80	80	80	80	80	100	14
72	72	72	71	72	100	15
80	80	80	80	80	100	16
84	90	90	90	90	100	14
97	98	98	98	98	100	19
80	80	80	80	80	100	14
92	92	92	92	92	100	14
90	89	89	89	88	100	20
80	80	80	80	80	100	14
82	82	82	82	82	100	14
98	98	96	100	98	100	14
92	92	92	92	92	100	14
97	98	98	98	98	100	18
80	80	80	80	80	100	14

82	82	82	82	82	100	18
81	81	81	81	81	100	16
114	114	114	114	114	100	15
82	82	82	82	82	100	14
80	80	80	80	80	100	15
84	84	84	84	80	100	14
76	74	72	74	74	100	14
84	84	82	82	80	100	14
97	97	98	98	98	100	18
80	80	80	80	80	100	17
82	82	82	82	82	100	16
80	80	80	80	80	100	14
82	82	82	82	82	100	14
97	97	98	98	98	100	18
80	80	80	80	80	100	17
82	82	82	82	82	100	16
81	81	81	81	81	100	16
114	114	114	114	114	100	15
82	82	82	82	82	100	14
80	80	80	80	80	100	15